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13 January 1984

East Europe Report

SCIENTIFIC AFFAIRS

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

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STATUS, DEVELOPMENT OF MICROELECTRONICS

East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 11, 1983 pp 687-689

[Article by Dr. Helmut Reimer, VEB Combine Microelectronics, Erfurt: "Status and Development of Microelectronics in the GDR"]

[Text] Status of Microelectronics in the GDR

The close and dynamic relationship between the development and the application of microelectronics is especially apparent in the case of electronic data processing and microcomputer technology. In a broader context, this leads to the relationship between the developmental stage of microelectronics itself and its utilization for the automation of production processes. The chart in Figure 1 here connects the entire spectrum of components of semiconductor and optoelectronics, as it is relevant for a process-promixate application in automation technology. It is clear that the solution of many current contemporary tasks of automation require performances within microelectronics.

The planned development and application of microelectronics has been intensely worked on in the GDR since 1977. The objective here is to procure components from domestic manufacture or through imports from the USSR and other socialist countries, components which are necessary for applications in

control and robot technology
computer technology and microcomputer technology
communications technology

and which are necessary for modern consumer goods.

An essential role is here played by the specification of the required component spectrum, with the greatest possible degree of uniformity, taking into account production capacities which already exist or which are being constructed. This is done jointly with the users. Figure 2 shows how complex this task is. Figure 2 shows the processing stages of microelectronics and its inclusion within the economy of the GDR. On this basis, high-quality and high-quantity growth rates for the production of microelectronic components have been reached since 1978 in the VEB Combine Microelectronics. Figure 3 shows how the spectrum of components from domestic production has expanded. The average annual production growth, during the from 1978 to 1982 was as follows:

for bi-polar IC 25.5 per cent
for MOS IC 36 per cent
for optoelectronic components 73 per cent.

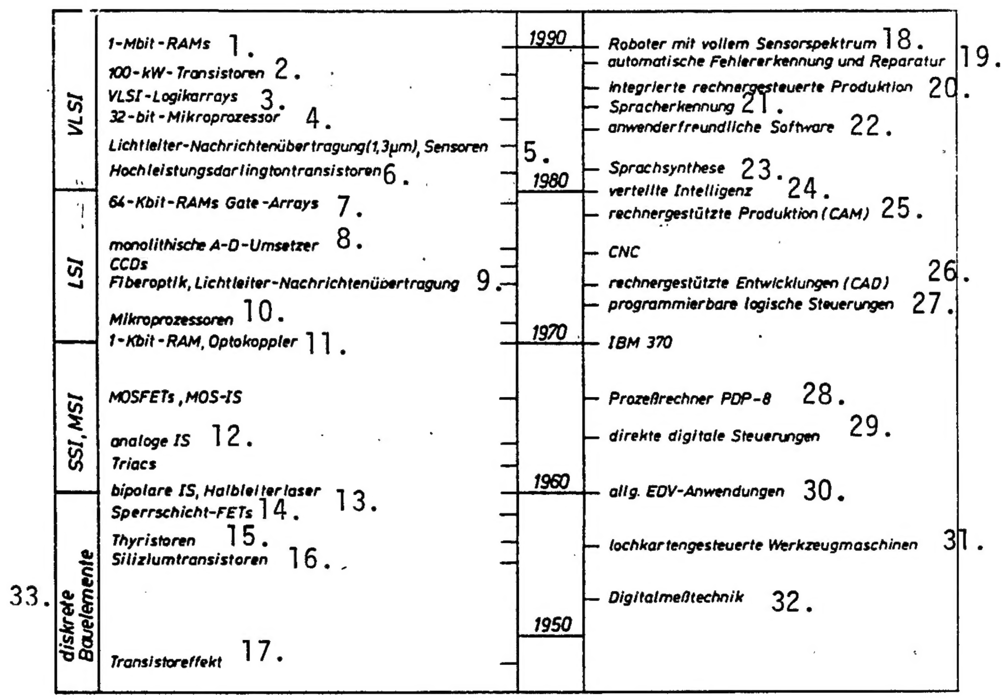

Figure 1: Development of Semiconductor and Automation Technology

Key:
1. 1-Mbit-RAMs
2. 100 kW transistors
3. VLSI logic arrays
4. 32 bit microprocessor
5. Light-conductor communication (1.3 μm), sensors
6. High-power Darlington transistors
7. 64-Kbit-RAMs Gate-Arrays
8. Monolithic A-D converters
9. Fiber optics, light-conductor communication
10. Microprocessors
11. 1-Kbit-RAM, optocouplers
12. Analog ICs
13. Bipolar ICs, semiconductor lasers
14. Blocking layer FETs
15. Thyristors
16. Silicon transistors
17. Transistor effect
18. Robots with full sensor spectrum
19. Automatic error detection and repair
20. Integrated computer-controlled production
21. Speech recognition
22. User-friendly software

Figure 1 Key, continued:

23. Speech synthesis
24. Distributed intelligence
25. Computer-supported production (CAM)
26. Computer-supported development (CAD)
27. Programmable logic controls
28. Process computer PDP-8
29. Direct digital controls
30. General EDP applications
31. Tool machines controlled by punched cards
32. Digital measurement technology
33. Discrete components

Figure 4 gives a survey of technologies that were production-effective in 1983.

At the same time, import volume for electronic components from socialist countries has grown steadily compared to 1980:

1981	121 per cent
1982	152 per cent
1983	197 per cent

Components of power electronics, semiconductor memories, and logic circuits were here mainly emphasized.

Thus, the users of microelectronics have available a spectrum of components which comprises a powerful 8-bit microprocessor system (U 880), an 8-bit single-chip microcomputer (U 881/U 882), semiconductor memories up to 16 K-bits, standard TTL-, LPS-, TTL-, and CMOS-construction series, operational amplifiers, analog switching circuits for entertainment electronics, a broad spectrum of optoelectronic display components, opto-couplers, and CCD line and power switching transistors up to 10 A from domestic production.

By 1986, a further doubling of the basic component types that will be produced is anticipated. The average increase in the production of microelectronics will amount to about 25 per cent per year. Then, among other things, 8 bit microprocessors with improved dynamic properties, a 16 bit microprocessor, memory circuits up to 64 K bit, an assortment of CMOS memories, 4 bit controllers, and transmission and receiving components for light-conductor communications will be available.

Microelectronic components are produced with the basic semiconductor materials silicon, GaAs, GaP, in the required quality from domestic production. For example, a broad spectrum of silicon wafers of Czochralski single-crystals with 100 mm diameter is being furnished for circuit production and a spectrum of silicon wafers of FZ single crystals up to 76 mm diameter, including neutron-doped material, is being furnished for the production of high-power electronic components.

For decisive technological complexes in the production of microelectronic components, equipment is available which has been developed locally. This concerns the generation and transfer of structures with a powerful family of devices from the combine VEB Carl Zeiss JENA, with projection illumination systems for step by step image transfer

onto the semiconductor wafers (AÜR), which, by 1985, will determine the level of the production of switching circuits.

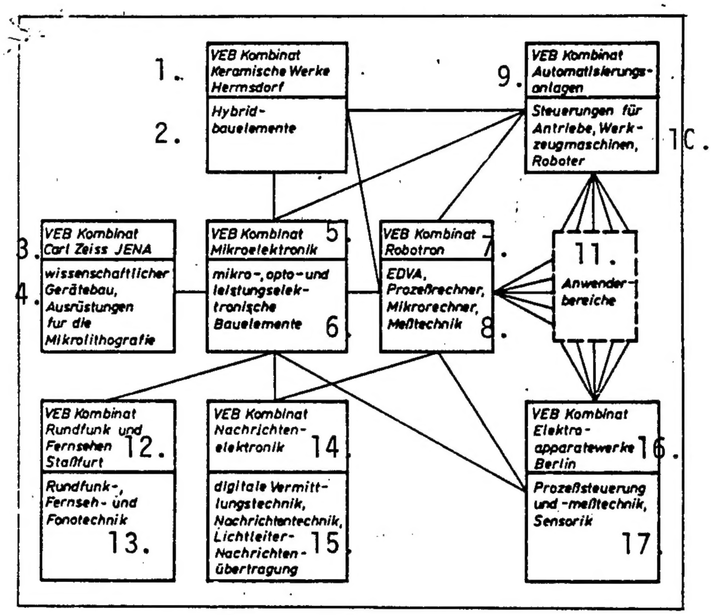

Figure 2: Important Cooperation Relationships Concerning the Development and Application of Microelectronics in the GDR

Key:
1. VEB ombine Ceramic Works Hermsdorf
2. Hybrid components
3. VEB Combine Carl Zeiss JENA
4. Scientific device construction, equipment for microlithography
5. VEB Combine Microelectronics
6. Micro-, opto-, and high-power electronic components
7. VEB Combine Robotron
8. EDP systems, process computers, microcomputers, measurement technology
9. VEB Combine Automation Systems
10. Controls for drives, tool machines, robots
11. User areas
12. VEB Combine Broadcasting and Video, Stassfurt
13. Radio, video, and telephone technology
14. VEB Combine Communications Electronics
15. Digital transmission technology, communications technology, light conductor communications
16. VEB Combine Electrical Apparatus Works, Berlin
17. Process control and measurement technology, sensor technology

The production program of the VEB Combine Microelectronics includes equipment for chip mounting and wire bonders as well as vaporization and sputtering coating systems.

Other equipment complexes, e.g. ion implantation, diffusion systems, and machine systems for the processing of silicon wafers are procured from the USSR. Through the

industrial areas of chemistry, metallurgy, and glass/ceramics, materials are increasingly being furnished especially for microelectronics, e.g. inorganic and organic highly pure chemicals, process gases, bonding wires, support strip materials, ceramic housings, semi-finished quartz products.

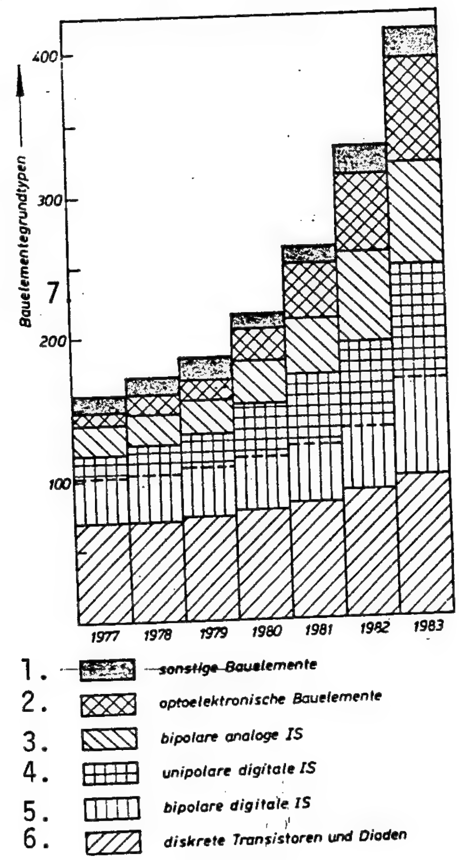

Figure 3: Development of the Component Spectrum in the VEB Combine Microelectronics

Key:
1. Other components
2. Optoelectronic components
3. Bipolar analog ICs
4. Unipolar digital ICs
5. Bipolar digital ICs
6. Discrete transistors and diodes
7. Basic component types

The Development of Microelectronics in the GDR

In agreement with international forecasts, the starting point in the GDR is that current applications of microelectronics make up about 10 per cent of the applications achievable by the year 2000. Consequently, the growth rates for the production of microelectronic components will continue to lie above the average development of the national economy even for the following years.

Automatisierungstechnik, 1. EDV-Technik, 2. Büroautomatisierung 3.			4. Nachrichtentechnik
Systeme für CAD, CAT, CAM 5. Mikroprozessor-systeme, 6. 7. Einchipmikrorechner	8, 16, 32 bit Zykluszeit ↓ 16.	VLSI	22. Funktechnik f → 20 GHz Lichtleiter-Nachrichten-übertragung 23. S/E: 0,85 μm; 1,3 μm; 1,6 μm
Speicher 8. (RAM, ROM, PROM).	Kapazität ↑ 17. Zugriffszeit ↓ 18.	VLSI	
Logik 9. (bipolar, MOS) 20.	Flexibilität ↑ 19. Leistungs-bedarf ↓ Arbeits- 21. geschwindigkeit ↑	Gate-arrays, LSI (VLSI)	digitale Nachrichtensysteme (Vermittlungstechnik, Signalverarbeitung) 24. LSI (VLSI) Ergänzung des Si durch $A_{III}B_V$-Technologie 25.
Sensoren 10. z. B. CCD (VLSI) Wandler 11. z. B. 16-bit-ADU Leistungselektronik 12. optoelektronische 13. Displays 14. Aktoren 15.			

Table 1: Perspective Requirements for Microelectronic Components (Examples)

Key:
1. Automation technology
2. EDP technology
3. Office automation
4. Communications technology
5. Systems for CAD, CAT, CAM
6. Microprocessor systems
7. Single-chip micro-computers
8. Memories (RAM, ROM, PROM)
9. Logic (bipolar, MOS)
10. Sensors e.g. CCD (VLSI)
11. Converters e.g. 16 bit ADU
12. Power electronics
13. Optoelectronics
14. Displays
15. Actors
16. 8, 16, 32 bit cycle time
17. Capacity
18. Access time
19. Flexibility
20. Power requirement
21. Working speed
22. Radio technology
23. Light-conductor communication S/E: 0.85 μm; 1.3 μm; 1.6 μm
24. Digital communication systems (transmission technology, signal processing)
25. LSI (VLSI) supplementation of silicon by A_{111} B_V technology

Objectively, the development of basic application structures, especially in automation engineering and communications technology, will create further demands on the performance parameters of microelectronic components (Table 1). The point here is especially to exhaust the relationship between the development of the use values of components and the intensification factors of their production, as shown in Figure 5. The transition from LSI to VLSI technology will occur in the GDR to a perceptible extent by the year 1990.

Compared to other technological innovation processes, the tempo of development and productive utilization of qualitatively new individual methods, process complexes, and complete technologies for the production of microelectronic components in cycle 1 is extraordinarily high. It should be noted here that new technological quality must here be secured simultaneously with growing production capacity. Thus, the time interval for the effectiveness of the new technologies in the manufacture of microelectronic components since 1976 has been 2.5 to 3 years (Table 2). With electronic devices and systems, this time has been 5 to 6 years and e.g. in machine construction it has been more than 10 years.

Corresponding to the principle of "unity of material, methods, and equipment", complex task definitions must thus be formulated, especially for decisive process complexes:

utilization of new action principles and their conversion into device solutions, e.g.

- structure transfer:
  contact-spacing-illumination, projection illumination 1 : 1,
  projection illumination X : 1,
  UV lithography
  electron beam lithography
  (x-ray-, ion beam-lithography)
- structurization:
  wet-chemical etching,
  plasma etching,
  reactive plasma etching,
  ion-beam etching

scientific penetration of process steps to implement the process verification and control, step by step development of process automation, process modeling, and computer-supported process and technology development

material development and optimization of material behavior in the technological process, in the sense of defect engineering, to increase the stability of technology and to increase the reliability of high yields

increasing the flexibility of the technological base with respect to implementable component functions to secure effective producibility of a broad component spectrum in close conjunction with the automation of cycle 1

transfer of technological principles and solutions for VLSI technologies to the production of further microelectronic components, such as analog and digital switching circuits, monolithic A-D and D-A converters, powerful electronic components, integrated sensors, etc.

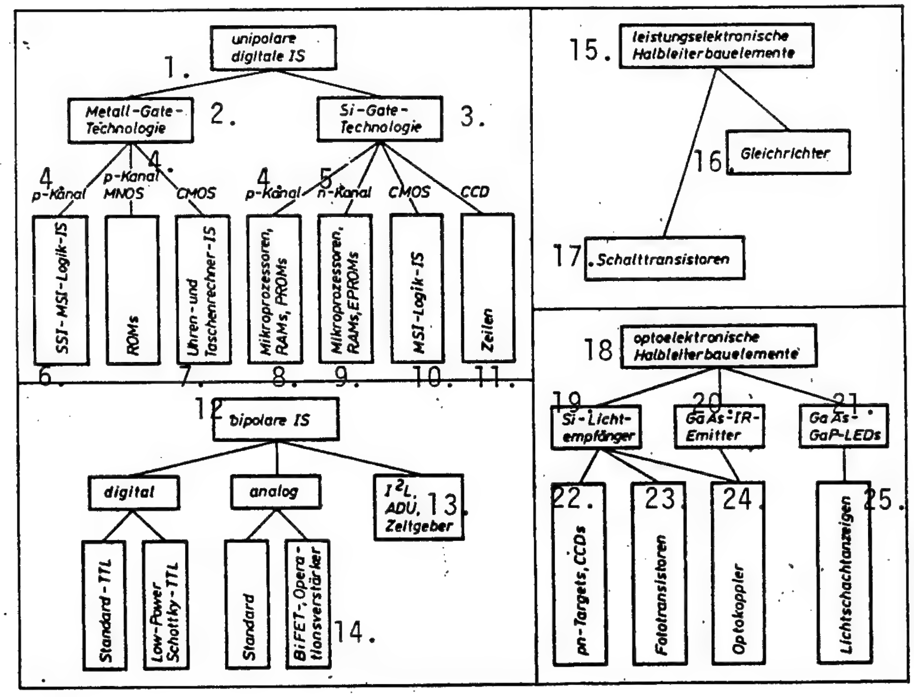

Figure 4: Production Technologies for Microelectronics in the VEB Combine Microelectronics (1983)

Key:
1. Unipolar digital ICs
2. Metal-gate technology
3. Si-gate technology
4. p-channel
5. n-channel
6. SSI-MSI logic ICs
7. Watches and calculator ICs
8. Microprocessors, RAMs, PROMs
9. Microprocessors, RAMs, EPROMs
10. MSI logic circuit ICs
11. Lines
12. Bipolar ICs
13. I^2L ADU, timers
14. BiFET operational amplifiers
15. Power-electronic semiconductor components
16. Rectifiers
17. Switching transistors
18. Optoelectronic semiconductor components
19. Si light receivers
20. GaAs IR emitters
21. GaAs GaP LEDs
22. pn targets, CCDs
23. Photo transistors
24. Optocouplers
25. Light shaft displays

1. Lateralstrukturbreite in µm	2. Positioniergenauigkeit in µm	3. Si-Scheiben-Durchmesser in mm	4. dRAM-Chipkapazität in Kbit	5. Einführungsjahr (international)
8	1	50/75	4	1976
4	0,5	75/100	16	1978
2	0,25	100	64	1981
1	0,2	125/150	256	1984
0,5	0,06	150	1 024	1987

Table 2: n-Channel MOS Technology Generations

Key:
1. Lateral structure width in µm
2. Positioning accuracy in µm
3. Si wafer diameter in mm
4. dRAM chip capacity in k bit
5. Introduction year (international)

	Gate-Arrays	anwenderspezifische LSI-IS 1.
Entwicklungszeit in Wochen 2.	8...12	75...100
Entwicklungskosten in Dollar 3.	50 000	500 000...700 000
wirtschaftlich ab 4.	2 000 Stück 14.	30 000 Stück

Gate-Array-Technologien 1982 5.

Hersteller 6.	Technologie 7.	Komplexität 8.	U_B in V	τ_G in ns	Entwicklungszeit in Wochen 9.	Spezifikation 10.
Fujitsu						
MB 60 000	CSGT	2 000 Gatter 11.	5	10	14	Hersteller 12.
MB 15 000	LSTTL	512 Gatter	5	1,8	12	Hersteller
Fairchild						
F 200	ECL	168 Gatter	−4,5	0,8	8...12	13. Anwender

Table 3: Gate Arrays for Complex Logic Systems

Key:
1. User-specific LSI ICs
2. Development time in weeks
3. Development costs in dollars
4. Economical as of
5. Gate array technologies in 1982
6. Manufacturers
7. Technology
8. Complexity
9. Development time in weeks
10. Specification
11. Gates
12. Manufacture
13. User
14. Units

Figure 6 defines the next stages in the development of VLSI silicon technologies. It contains the characteristic properties of the component generations.

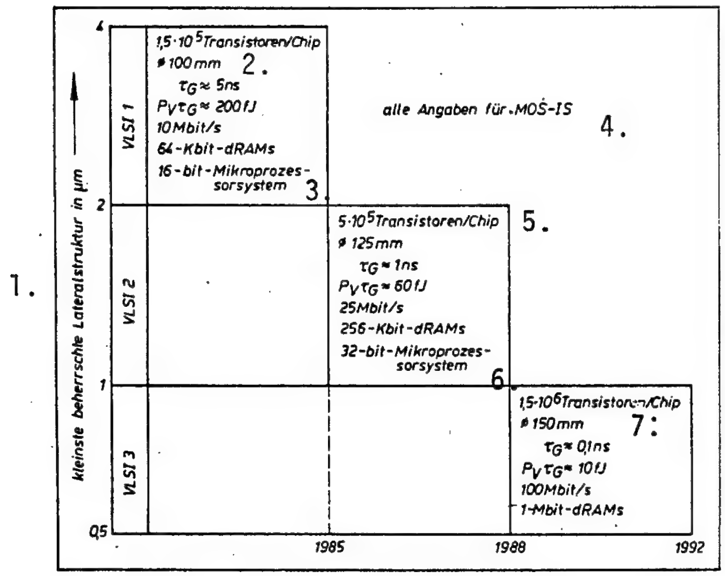

Figure 5:

Key:
1. Smallest achievable lateral structure in µm
2. Transistors per chip
3. Microprocessor system
4. All data for MOS ICs
5. Transistors per chip
6. Microprocessor system
7. Transistors per chip

In order to achieve the currently known limits of integration in silicon, further quality changes in the technology after 1990 must be prepared for.

Further research and development programs are being implemented for high frequency and ultrahigh frequency components, optoelectronic components, and high-power electronic components. Here, the further use of $A_{III}B_{V}$ semiconductor materials as a supplement to silicon is being prepared.

The integration densities of VLSI technologies, as shown in Figure 6, directly indicate that, with the development of the technological base of microelectronics, design and application technologies with adequate performance capability are also necessary. Through their development, the preconditions are created for the component spectrum continuing to correspond to user requirements and simultaneously exhausting the available technological base. Supplementing a widely usable standard assortment through user-specific components (master slices, gate arrays, apecial processors, etc.) will here be especially important. These secure the expected requirements for functional flexibility in the case of logic systems, short preparation times, and low cost with small numbers of units (Table 3). Their effective use simultaneously presupposes collaboration between microelectronic manufacturers and users.

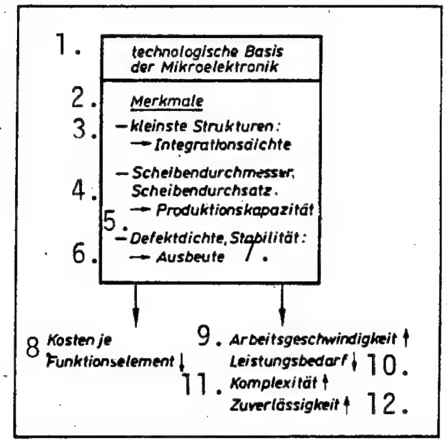

Figure 6: Connection between Use Value and Production Intensification of Components

Key:
1. Technological base of microelectronics
2. Characteristics
3. Smallest structures: integration density
4. Wafer diameter, wafer throughput
5. Production capacity
6. Defect density, stability
7. Yield
8. Cost per function element
9. Working speed
10. Power requirement
11. Complexity
12. Reliability

8348
CSO: 2302/14

RESEARCH PROJECTS OF SAXON ACADEMY OF SCIENCES

Leipzig LEIPZIGER VOLKSZEITUNG in German 11 Oct 83 p 4

[Interview with Dr Werner Bahner, President, Saxon Academy of Sciences at Leipzig, by Dr Rolf Moebius: "Research for the Environment and Inheritance;" exact time and place not given]

[Text] [Question] Comrade President, the Saxon Academy of Sciences (SAW) sometimes is greatly misunderstood by the public. Some measure it against the Academy of Sciences of the GDR (AdW), others--who know that that is not an appropriate measuring stick--even think of it in terms of the last century. What is SAW really?

[Answer] It is true that it does not have thousands of coworkers and numerous institutes at its disposal like the AdW, but is a "community of outstanding scholars," as its charter states. It cultivates above all an interdisciplinary exchange of opinions of experienced scientists, which is a component of the most important methods of modern scientific life and for this reason takes its proper place in plenary sessions, classes and commissions of our academy.

The SAW, through some of its projects, is firmly integrated in our country's central research planning. For this purpose we have a number of full-time staff members at the Saxon Academy. Other subjects are part of "initiative research" developed independently in "free space," which science needs in order to develop and test new approaches and ideas.

[Question] And the results?

[Answer] They range from economically significant results--which are also of interest to many citizens--to research work which, by its nature, is noted only by a small circle of specialists.

In the former case I am thinking especially of work being directed by our commission for special environmental problems. Several work teams are studying, for example, how to avoid the use of chemical insecticides by applying biological means not endangering man or mammals, or--closely connected with this--how bodies of water with strong chemical contaminants can be cleaned

up or managed. This aims at management strategies for dams, residual water from strip-mines, and other standing bodies of water, and has saved considerable investment--for instance, through finding such a strategy for the Ohra dam, or through prediction of the growth of phytoplankton in the Muldenstein storage lake which provides the water supply for the Wolfen film factory.

In a conversation with comrade Horst Schumann, first secretary of the SED district administration of Leipzig, the SAW presidium found great interest in these projects. He proposed to study, together with the district council, which of the results presented can also be utilized in the Leipzig district, and which particularly important problems of environmental protection could perhaps be included in SAW research projects.

[Question] On the subject of environmental protection, SAW has a prize competition...

[Answer] ...yes, jointly with the Chamber of Technology. It is a matter of outstanding achievements--scientifically founded and useable--especially for the protection of water and the secondary use of pollutants connected with it, i.e., preservation of material. We have received many entries.

[Question] And what about the work which is less in the public eye than environmental protection?

[Answer] You are probably referring to some philological works. Well, it is true that not every GDR citizen acquires a dictionary of Old High German, which has been appearing since 1962 with one or two editions annually, and contains the complete German vocabulary from the beginning of records around the year 750 to the 11th century. It stands high in international esteem and represents an extraordinary work on the formation of our language.

The situation is different in the case of multiple-volume dialect dictionaries for large regions such as Mecklenburg, Brandenburg, Thuringia and Upper Saxony, which describe origin, usage and dispersal area. Numerous inquiries and some popular-scientific activities of our colleagues demonstrate the great interest in this work which is based on decades of basic research--incidentally, with the voluntary cooperation of hundreds of interested laymen in town and country in the collection of proof; that amounts to nearly 1 million loose pieces of paper for every dictionary! We must never forget that for centuries, dialects were the only means of oral communication for the working people.

Research on names is also a part of regional language research, undertaken jointly under contract with the Karl-Marx-University which, thanks to Leipzig's international reputation in this field, will host in 1984 the world congress for research into names.

[Question] Your last sentence offers an opportunity to discuss the international reputation enjoyed by the Saxon Academy...

[Answer] The scientific and cultural-historical value of the last-mentioned works which have long stamped the research profile of the Academy, actually do receive highest international recognition. The "Poggendorf" also, i.e., the "Biographic-literary dictionary of exact natural sciences," founded 120 years ago by J.C. Poggendorf, which has been continued by our Academy for decades, is a significant scientific and cultural-historical achievement.

The SAW reputation abroad can also be seen in the number of exchange partners. There are 412 institutions in 49 countries from which we receive the latest research reports and to which we send corresponding publications. They are distributed all over the world--the exchange is, naturally, especially intensive with the USSR, our brother countries and neighboring states, but it also covers Argentina and China, Canada and Australia, Senegal.

[Question] We have not yet touched upon the work of the historical commission of SAW?

[Answer] And actually, it is a good example how unobtrusive basic research over many years is the prerequisite for being able to present at the right time results which have broad effects.

During its almost 90 years of tradition, the commission--which was directly incorporated into the Academy in 1956--has to a high degree continued its work with source materials, bibliographies, etc, which naturally have not become widely known to the public but have been indispensable at all times for scientific work. I have in mind the historical listing of place names in Saxony; the bibliographies for the history of the cities of Leipzig, Dresden and Karl-Marx-Stadt; the work currently in progress on the political correspondence of Duke and Elector Moritz of Saxony, a multiple-volume source material on the history of the 16th century, which is not only significant for Saxon history; and the historical atlas of Saxony, a tome of maps from prehistoric and early historic times up to the present, which is in preparation.

These research works are in context with the latest project of the commission, which will arouse much interest: A "Saxon history," a complete presentation from the settlement of this territory to the creation of districts in 1952. It will appear in 1985 or 1986.

Next year, an international colloquium on this subject will be held by SAW in close cooperation with the KMU [Karl-Marx-University]. In 1982/83, a lecture cycle was held on the same subject jointly with the Cultural League, which was published in the SAECHSISCHE HEIMATBLAETTER.

[Question] ...Which indicates the intellectual and cultural influence of the Academy on the territory, especially at its seat--after all, its precise name is Saxon Academy of Sciences at Leipzig.

[Answer] In many varied ways, our members are also active in popular-scientific fields. The Academy promotes such relationships--it invites, for

instance, teachers in specific fields to its public sessions for the Leipzig public. However, we do hope for greater response to these--the next public session on November 18 is dedicated to the Luther anniversary; Prof Grosse will speak on Luther's achievements for the German language, and Prof Ullmann will speak on art of the time of the Reformation.

[Question] We shall remind our readers of it once more, and we thank you for the interview, Comrade President.

9917
CSO: 2302/15

PROCESS DEVELOPED FOR DESULFURATING OF FLUE GAS

Magdeburg VOLKSSTIMME in German 28 Oct 83 Supplement p 3

[Article by Dr.B. Kahn, F. Grossmann: "Method for Desulfurating Flue Gas Successfully Applied"]

[Text] The adequate and effective supply of energy for the political economy and the population is the essential precondition for the successful realization of the main task in the unification of economic and social policy. In doing so, domestic lignite plays a dominant role for us in supplying energy needs in the foreseeable future, it is the number 1 principal energy source. Its conversion into other forms of energy, for example electrical energy, gas or liquid fuel and motor fuel, and also the direct use for heating purposes, is connected as a rule with combustion processes.

Reactions such as the oxidation of sulfur in coal to sulfur dioxide and to a slight extent to sulfur trioxide, as well as the partial oxidation at the same time of nitrogen to nitrogen oxides, are unavoidable. Nonetheless, according to previous existing findings, these oxidation products have caused damage, since they, for example bring about an over-acidity in forrests. The extent of such damage is determined essentially by the sulfur content in the fuels of which heating oil and bituminous coal, and not only lignite contain sulfur. Concerning the matter of nitrogen oxides, the relatively low combustion temperatures of lignite compared to other fuels have a decidedly favorable effect. Scientists, engineers and economists in our country have for along time studied in theory and practice the processes which are directed to avoiding of the emission or at least the reduction of pollutants.

Extensive investigations have led to the conclusion that for the removal of sulfur from flue gases (when burning our domestic lignite) under present circumstances, through the process of adding dry limestone to the lignite (translator's note: in the U.S. this is called fluidized-bed combustion). In collaboration with experts-especially from Elbe Power to the Lignite Power Combine--associates of the Institute for Energy/Central Office for Rational Energy Use developed and demonstrated this process to such an extent that it is now applicable in practice.

In the course of scientific work it became obvious that the "IfE Process for Desulfurization of Flue Gases" does even more than just containing sulfur dioxide. By the reduction of pollutants in flue gases, especially through the nearly complete absorption of the sulfur trioxide, it became possible to reduce the flue gas temperature from the otherwise required temperature of approximately 180°C to a level around 120°C, without going below the acid dew point. That means, in spite of the reduced flue gas temperature the dreaded condensate of sulfuric acid fails to appear in the steam generator. Because of this it is possible to install larger heat exchangers to recover additional BTU's.

In the drive for maximum utilization, the associates were also concerned with the use of products contained in the filter ash. Concerning the use of the ash several possibilities for applications are being tested. Thus there is its possible use, among other things for the neutralization of acid seepage and the reclamation of strip mine sties. According to experiments carried out in conjunction with the cement industry, there is also the use (to a limited extent) of this ash as an additive to cement powder. The erection of an installation with a 160 ton/hour steam boiler by Elbe Power in Vockerode for full-scale evaluation of the process and its economics has completely confirmed its effectiveness and technical usefulness in practice.

The results achieved, even with the binding of the sulfur dioxide and the additional obtention of heat for residential heating, speak for the utility of this process in heating plants, especially heating plants in areas of great population density. With regard to the avoidance of harmful emissions, it is significant that these processes can be used in mill furnaces and small plants having firegrates.

With the plant Elbe Power, an example is established of how in a short time new processes may be used for the improvement of environmental protection in currently operating power plants. At the same time it is established that difficulties of rational energy use and energy conversion can be solved. These results were achieved above all through close cooperation between scientists and development personnel.

With the processes developed by the Energy Institute/Central Office for rational energy use, the economy of the German Democratic Republic has as the Minister for Environmental Protection and Water Economy, Dr Hans Reichelt, amplified in a recent ADN interview--"a tested process for the desulfurization of flue gases during the combustion of lignite that shows great economic potential."

Currently a concept for the further application of the process is being tested. It even has precedence over the reduction in the concentration of pollutants and a reduction of the sulfur dioxide emission. Also under consideration however is the recovery of additional heat and the optimization of the bulk flow for limestone transport.

The scientists for the Energy Institute/Central Office for rational energy use and Elbe power plant consider the successful development and evaluation of the process for desulfurization of flue gases as valuable contribution to the accomplishment of the economic strategy of the 10th Party Congress of the SED,

preferentially oriented to the use and increased improvement of our domestic raw materials and energy sources.

Along with the desulfurization of flue gases the scientists of the German Democratic Republic work intensively on the cultivation of smoke resistant conifers. Thus in the Nursery for Forest Growth, Waldsiverdorf (of the Institute for Forestry, Eberswalde), a process has been developed which permits propagation of smoke resistant spruce and Douglas Fir by way of seedlings. Dr Erhard Georgi cuts Murray Pine on a 2.5 hectar seed plantation in order to reduce the rate of upward growth and to make it easier to harvest.

12388
CSO: 2302/9

FIRST LARGE-SCALE BIOGAS FACILITY DESCRIBED, EVALUATED

East Berlin AGRARTECHNIK in German No 11, 1983 pp 508-510

[Article by Dr G. Breitschuh, Cooperative Department for Melioration and Organic Fertilization, Vippachedelhausen; Dr W. Neumann, Chamber of Technology, Technical Advanced School "Carl Schorlemmer," Leuna-Merseburg; V. Heimboldt, engineer, Chamber of Technology; K. Roedel, engineer, Chamber of Technology, VEB Dresden Complete Chemical Plant: "Inauguration of an Industrial Biogas Plant in Agriculture"]

[Text] 1. Introduction

The first large-scale agricultural biogas facility in the GDR was placed in operation in December 1982 in Vippachedelhausen in the airport district. It has been constructed as a large-scale test facility but can also be used as a normal production plant. The facility is based upon a process developed by the VEB Dresden Complete Chemical Plant, by the Technical Advanced School "Carl Schorlemmer" in Leuna-Merseburg and by the Cooperative Department for Melioration and Organic Fertilization in Vippachedelhausen.

Operation of this facility is expected essentially to provide information with regard to

i. an optimal process configuration and plant configuration,

ii. the scale change from process-kinetic parameters determined under laboratory conditions,

iii. the stability and optimal control of biogas reactors,

iv. the profitableness of biogas facilities.

Moreover, it is intended that experience shall be gathered relating to the operation and maintenance of complete biogas facilities under the specific conditions of agriculture in the GDR. In accordance with these goals the facility is provided with relative flexibility in terms of its basic design.

2. Description of the Facility

The entire facility complex consists of a biogas reactor, corresponding storage vessels for the output substrate and the decaying material, as well as a phase-separating facility and a unit for biogas utilization [or "evaluation"].

Figure 1 shows a simplified engineering diagram for the facility. The structure of the facility arose out of expansion of an already existing manure preparation facility around the corresponding subsystems for biogas generation and utilization with maximal exploitation of existing technological equipment and buildings.

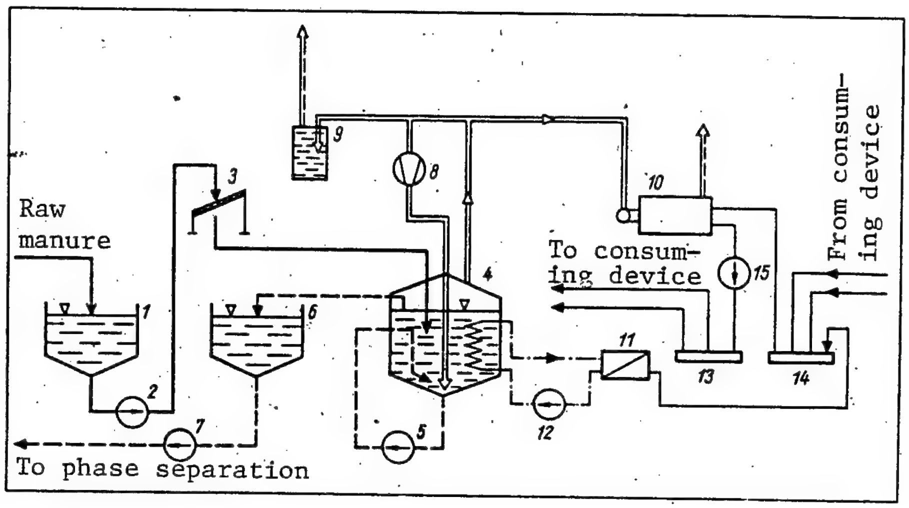

Fig. 1. Simplified engineering diagram for the biogas facility: 1--manure storage vessel; 2--feed pump; 3--sieve; 4--biogas reactor; 5--substrate circulating pump; 6--storage vessel for methane sludge; 7--methane sludge pump; 8--compressor; 9--overpressure relief valve (immersion gas collection); 10--automatic warm-water device; 11--heat transfer device; 12--heat circulating pump; 13--hot-water input distributor; 14--hot-water return distributor; 15--hot-water circulating pump.

The raw manure emerges from the stables and enters the manure storage vessels 1. From here in order to separate out the coarse material it is conducted to a large mesh sieve 3 and pumped in batches into the biogas reactor 4. The reactor has a volume of about 500 cubic meters and consists of a cylindrical concrete body with a steel cover which is surrounded on the outside with heaped up soil (Figure 2). The heating of the reaction mass is accomplished by means of a heat transfer device in the interior. The thorough mixing of the reaction mass can be carried out both hydromechanically and also by the introduction of concentrated biogas. Discharge of the reactor is accomplished by free overflow while it is being loaded. The methane sludge enters storage vessel 6 for subsequent fermentation and is finally delivered to a phase separation process.

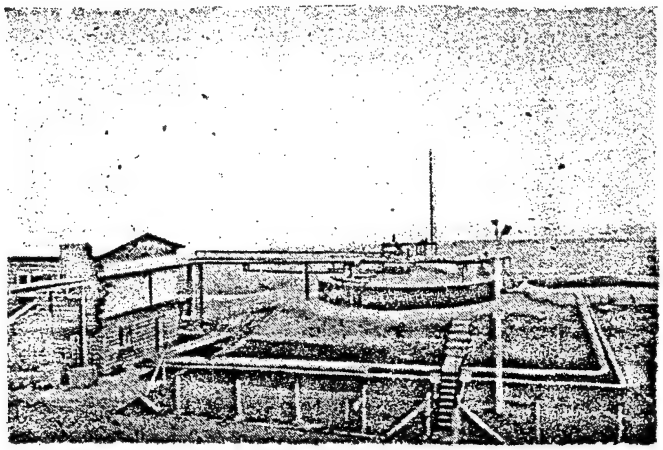

Fig. 2. Biogas reactor.

Utilization of the biogas takes place in an automated warm-water unit 10 where heat energy is generated which is also in part used for heating the output substrate in the reactor. At the present time there is no storage of the biogas. When appropriate any excess biogas can be conducted via a suitable immersion gas collection device 9 to an exit torch and released into the environment.

3. Substrate Characterization and Process Conditions

The biogas facility is provided exclusively for the fermentation of manure. The specific location of the facility permits processing of swine manure, cow manure and in part chicken manure. On the basis of corresponding results of kinetic investigations, in the normal course of events a mixture of cow manure and swine manure is processed in a ratio of about 1:1. The organic dry mass component of swine and cow manure is between 3.5 percent and 5 percent.

The design of the biogas reactor permits fermentation only in the moderate temperature range, but within this range the reaction temperature is variable. A fermentation temperature of about 35° C has turned out to be economically best. At this temperature the biogas reactor can also be operated even under the maximal allowable substrate loading. The pressure in the gas chamber of the reactor may vary within a range from 2.0 to 5.0 kPa. An intermediate concentration of the biogas before its utilization is not required at this pressure level. The biogas is utilized without any preceding gas purification. The biogas reactor can be operated both discontinuously and also quasi-continuously. The mixing of the reaction mass can take place continuously but is generally carried out only at intervals.

4. Putting the Facility Into Operation

Placing biogas facilities into operation is not without its problems from the point of view of safety and process engineering. If the gas chamber of a biogas facility is not rendered inert before the start of biogas formation

there sometimes occurs in the gas chamber of the facility an explosive biogas-air mixture having a lower ignition limit of about 6 percent and an upper ignition limit of about 12 percent. When a source of ignition is present at the same time within the explosive range and having sufficient ignition energy an explosion results. Of course, biogas facilities which are suitably designed from the point of view of safety practically exclude such cases of ignition.

From the process engineering point of view the startup process of biogas facilities can become critical in the sense that under unfavorable startup conditions the nonstationary operating phase (startup phase) lasts a long time while on the other hand there exists the danger of overacidification of the reaction mass through the excessive introduction of fresh substrate. Information is given in [1] about miscarried startup tests of biogas facilities.

Prior to placing the described biogas facility in operation there was a simulation of the startup process under laboratory conditions with the substrates which were to be processed. Without any inoculation with fermenting sludge it was thus possible to carry out the startup process most effectively using fresh cow manure. Satisfactory results were also obtained using chicken manure and various manure mixtures. Because of the high concentration of carbonic acids in the swine manure startup tests using this uninoculated substrate did not produce acceptable results.

The inoculation of cow manure, chicken manure and mixed manures with fermenting sludge (mass fraction 1 percent) resulted in a substantial acceleration of the process. Also older methane sludge (3 to 6 months old) acquired at substantially lower fermentation temperatures when used as an inoculation substance displayed an activity which while limited was nevertheless satisfactory.

A dry substance content of 1.4 to 3 percent was determined to be an optimal solid concentration of the substrate for the startup process. The startup process of the large-scale biogas facility was carried out with cow manure which had a dry substance content of about 2 percent. The gas chamber of the biogas facility was rendered inert after attaining the desired fermentation temperature of 35° C by aerobic decomposition of a part of the oxygen contained in the air. To this end gas was sucked into the circulation from the gas chamber by means of a compressor and was compressed throughout the reaction mass. This process was terminated upon attainment of an oxygen concentration in the air amounting to about 2 percent (by volume). In order to accelerate the startup process the reaction mass was inoculated with about 16 cubic meters of specially produced methane sludge. Figure 3 shows the variation in O_2 concentration with time in the gas chamber during the process of rendering the chamber inert. The biogas development started some hours after conclusion of the inoculation. In the first few days no fresh substrate was introduced. No attempt was made to thoroughly mix the reaction mass. For the introduction of substrate in the subsequent days the concentration of the water-vapor-volatile carbonic acids and the intensity of the biogas production were employed as control parameters. At first no swine manure was introduced. The increase in the loading of the reactor with substrate took

place very carefully in order to assure adequate adaptation of the methane-forming microorganisms to the substrate and to the increasing concentration of the volatile carbonic acids. To the degree that the process stabilized, the swine manure fraction in the substrate was increased up to a mass fraction of 53 percent. The upper admissible limiting value for the concentration of water-vapor-volatile fatty acids was established at about 2.0 grams per liter.

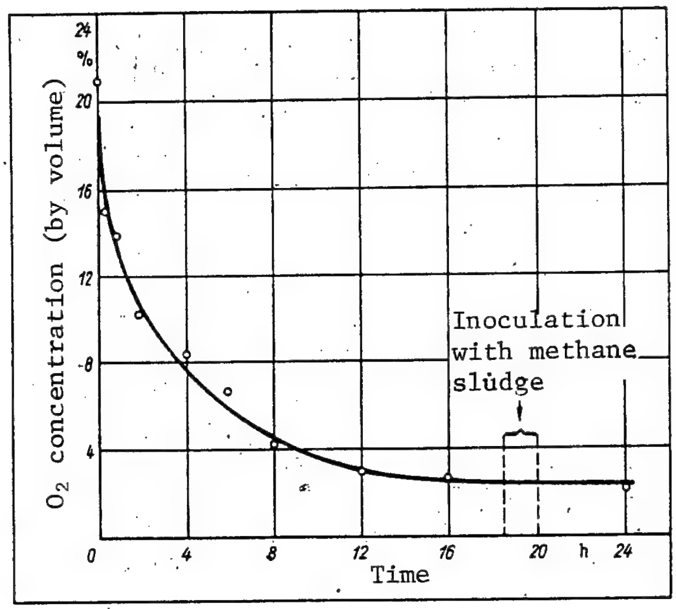

Fig. 3. Change in O_2 concentration of the air in the gas chamber with time during the process of rendering the chamber inert.

The introduction of fresh substrate was quasi-continuous. The thorough mixing of the reaction mass was carried out at intervals by pumping biogas. The specific energy consumption of the compressor was extremely low.

Figure 4 shows as a function of time the development of specific biogas production K_V and of specific biogas yield ϕ_{BG}. The drop in specific biogas production at times corresponds to the reduced introduction of substrate during the corresponding interval of time. This showed clearly how sharply the methane formation process may be influenced. The relatively high stationary value of the specific biogas yield ϕ_{BG} indicates the great degree of decomposition of the organic material and indicates a favorable process course.

The development of the specific biogas production as a function of time and also the development in the course of time of the mean value of the water-vapor-volatile fatty acids in the substrate suggest that a further loading of the reactor with substrate is possible and that it is possible to attain a value for the specific biogas production K_V per day of about 2 cubic meters of biogas per cubic meter of reaction mass with a mean sustained presence of the reaction mass for a period of 10 days. The pH value of the effluent

water is relatively high being between 8.2 and 8.4 and indicates the high buffering effect of the reaction mass. The methane fraction (by volume) in the biogas is between 65 percent and 72 percent.

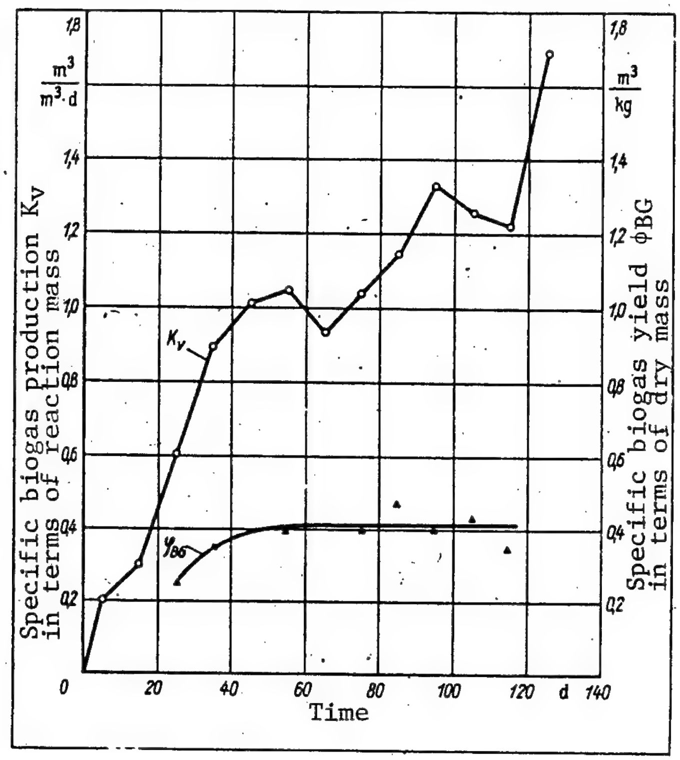

Fig. 4. Development of the specific biogas production K_V and of the specific biogas yield ϕ_{BG} in the startup phase of the facility.

5. Conclusions

The following initial conclusions may be drawn from a half year's operation of the large-scale biogas facility:

i. There has been confirmation of the observation in [2] regarding the more favorable anaerobic fermentability of certain mixed manures as compared with single manures.

ii. The results of the kinetic investigations of anaerobic fermentation of manure on a laboratory scale correspond basically to the results obtained in the large-scale facility when the same substrate was used. Since the flow-dynamic conditions in the laboratory reactor and in the large-scale reactor differ the factor which determines velocity in the formation of biogas even at a relatively low intensity of mixing of the reaction mass must be the biochemical conversion and not the material transport. Of course, in biogas reactors without thorough mixing of the reaction mass there are obstructions to the process resulting from low diffusion.

iii. The mixing of the reaction mass by means of biogas turned out to be very effective. This fact relates to specific energy consumption, the reliability and the technological effectiveness (destruction of the flotation layer, concentration equilibrium in the reaction mass, etc.). The suggestions given in [3] and [4] with regard to the special effectiveness of hollow-shaft agitators with paddles should in no case be generalized.

iv. It is possible without any problems to make use of biogas without biogas pretreatment in warm-water automatic devices of domestic manufacture, thanks to the combustion properties of biogas, without any modification of the burners over a broad loading range. An inspection of the automatic devices has thus far revealed no significant corrosion phenomena.

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8008
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NEW MEDICAL TECHNOLOGY EXHIBITED AT LEIPZIG FAIR

East Berlin DAS DEUTSCHE GESUNDHEITSWESEN in German No 43, 1983 pp 1699-1700

[Article by W. Seidel: "A Machine for Storage of Organs--Main Attraction Among New Developments at Fair"]

[Text] This year again, the VEB Combine Medicine and Labor Technology [MLW] in Leipzig is the largest and most significant exhibitor at the Medical Technology Branch Exhibit of the Autumn Fair in Leipzig, in the Bugra Exhibition Pavillion. Its offerings range from disposable products through apparatuses and automation all the way to the planning and equipment of complete health facilities and laboratories.

The fair exhibit of the combine includes over 30 new and further developments of great practical utility and clearly increased applicability value which were often achieved by the use of microelectronics.

OKM, the new machine for the storage of organs, which is of extraordinary importance to health policy, was developed in close cooperation among foremost practicing specialists and research scientists from the Experimental Organ Transplantation Section of Humboldt University in Berlin and the Kidney Transplantation Center of the Berlin-Friedrichshain City Hospital. Through the newly developed principle of functionality and the use of microelectronics, a not yet internationally achieved adaptation of the stored organ--especially the donated kidney--is provided which is close to the physiological conditions in the human organism. The optimal adaptation to the natural biological requirements prolongs the storage period for kidneys severalfold, up to 72 hours, both in stationary and mobile storage units without any demonstrable damage to the stored organ. Thereby a new grade of quality has been reached in the system of national and international organ exchange which leads, among others, to a higher recovery rate of transplantable donor kidneys. Simultaneously, the conditions are provided for better donor-receiver selection and for an improved rate of surgical success in kidney transplants.

The increasing demands for safety-technological features and for operator comfort are accommodated by the combine through steady and targeted, new and further developments in anesthesia machines and accessories. Thus Medimorphy, the well-proven inhalation anesthesia machine was equipped with accessories

and components such as a monitor for oxygen failure and a unit for anesthetics circulation.

The oxygen-failure monitor with nitrous oxide shutoff was integrated into the instrument frame. It prevents the use of hypoxic breathing mixtures, increases the safety of the patient and lowers the expenditures for human monitoring. If pressure fails or drops below a minimum, the attendant is warned by sound. If a transfer to reserve gas does not take place, the functional unit shuts off any further nitrous oxide flow.

The new anesthetics circulation unit was constructed as a compact apparatus with an optimal arrangement of the functional elements for the minimal consumption of fresh gas and respirator-lime. The full respirator-lime volume is sufficient for the secure uptake of CO_2 during the entire day of surgery.

Unisog 250, the new surgical suction apparatus can be used universally. It serves to suction off thoracic, cerebral, tracheal and abdominal fluids. With an available attachment, the apparatus can also be used in obstetrics for the Malmstroem procedure and for abortions. The parts channeling the secretion are outside of the apparatus, and can be easily disinfected and sterilized. The exhaust air is additionally led through a bacterial filter so that no infectious germs can enter the surgical or treatment area.

The new sinus irrigation system according to Vogt provides for a true expansion of diagnostic and therapeutic possibilities. It consists of a modified needle cannula to puncture the maxillary cavity and a cannula to be left in the frontal cavity, with corresponding accessories. The maxillary cavity cannula with the rinsing system attached to it provides the possibility of completely removing pathological secretions from the maxillary cavity, especially in the case of an occluded ostium. The cannula can also be used to measure pressure during the rinsing and to test the functioning of the opening to the maxillary cavity. After the completion of Beck's drilling, in combination with the frontal-cavity rinsing system according to Vogt, complete removal of secretion from the frontal cavity can be achieved and the measurement of functional parameters is also possible.

The new polyethylene microcatheter is used for measuring arterial cardiac pressure and for routine cardiological diagnoses. As a thin cardiac probe, the catheter is introduced percutaneously into the vascular system and it is floated into the heart and pulmonary artery by the blood stream. Location of the catheter tip is done from pressure graphs, without X-ray control. Thereby personnel and instrumental expenditures remain slight and this is a considerable advantage compared to the traditional heart examination with diagnostic catheters. Further advantages are provided by the rapid and secure catheterization which is accompanied by no stress to the patient. The risks of a catheter embolism are removed since introduction is done through a cannule made of synthetic material. The good staying power makes possible a permanent right-cardiac catheterism and the simultaneous evaluation of left-cardiac function.

New radio-opaque ring-cardiac catheters are offered in special variants for adults, children and [use in] the abdomen. The disposable products consist

of soft polyethylene and have a stopcock. They are sterile and are produced in sizes between 5 and 10 Charriere with varying lengths.

A new, sterile package of infusion equipment is used to transfer infusion solutions with or without increased pressure. It consists of a puncture cannual with double lumen and air release on its side. The double-lumen plastic cannula has a flexible filter chamber mounted on it, containing a fine filter to keep back eventual impurities.

The novelty program of the MLW Combine also includes various medical emergency bags for rapid medical aid, Urgent House Call Service, resuscitation and the drawing and transfusion of blood. In the tightest possible space, the required tools, instruments, medications and other needed materials are laid out ready to be grabbed and easily visible. The basic equipment consists of a catheter and laryngoscope as well as equipment and instruments for suction, artificial respiration, infusion, transfusion, injection, diagnosis, suture and bandaging. The bag itself is made of sturdy polystyrene guaranteeing the robustness required for ready use in medical practice.

Primarily for use in the blood-donation system, in the pharmaceutical industry and for initial concentration work in chemical and biological research laboratories, a new, cooled centrifuge, the K 80, was developed. It makes a higher centrifugation performance possible and improves operator comfort. The centrifuge, equipped with microelectronics, has a digital display for revolutions, rotor temperature and operation time. The operational parameters can be preprogrammed in four work cycles and the working functions are optically indicated.

The many novelties of the combine for the Liepzig Autumn Fair include, among others, water baths and magnetic stirring devices, a fixed volume dosage dispenser and a temperature recorder, a raw protein titrator and a rotary vacuum pump, an energency medical aid vehicle and three hot-air sterilizing machines as well as an intrauterine device with high contraceptive effectiveness.

2473
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CANDID TALK ON TECHNICAL DEVELOPMENT, ECONOMIC POLICY BY POLITBURO MEMBER

Budapest MUSZAKI ELET in Hungarian 24 Nov 83 pp 3, 6

[Text of a speech by Ferenc Havasi, secretary of the MSZMP Central Committee and member of its Politburo, at the national conference of the plant and institutional organizations of the Federation of Technical and Natural Science Associations]

[Text] Honored Conferees, Dear Comrades:

On behalf of the MSZMP Central Committee and the government of the Hungarian Socialist Republic, allow me first of all to respectfully greet this conference of the plant and institutional organizations of the MTESZ [Federation of Technical and Natural Science Associations] and to convey Comrade Janos Kadar's sincere best wishes.

The importance of today's conference stems primarily from the efforts of the MTESZ to better serve production and the economy with all the strength, experience, talent and intellectual ability that the federation possesses. These efforts, in my opinion, are commendable and deserve support, especially now, under the well-known economic and political conditions.

It is unnecessary to dwell in detail at this conference on rating the work of the MTESZ, but I think that some thoughts on this will nonetheless be in order.

If we rate the federation's work from the viewpoint of how it serves the most important objectives of policy, and within it of economic policy, how it aids by its specific means the realization of the principal goals, primarily of improving economic equilibrium and of preserving the standard of living, then we may say that the role of the MTESZ in this process is becoming more and more progressive. Likewise very important from the viewpoint of rating the work of the MTESZ is, I believe, the noteworthy success of the MTESZ in raising the level of professional training and in fostering a sense of vocation among the theoretical and practical experts and intellectuals in the technical, economic and natural sciences. On the basis of the successes in this area, we can only request and encourage the federation and its associations to continue their activity in this direction.

The conferees are probably aware that our system of macroeconomic management is being streamlined. Speaking in this context of the interrelations between

economic management and technical development, I would like to dwell first of all on the much-debated question of the extent to which we are able to influence and stimulate technical development, and whether we are heading in the right direction in technical and technological development. When considering this question, we must start out first of all from the fact that in our present practice the tasks of technical development are divided between the government and the enterprises, and that central management in this area is accomplished essentially by indirect means. Naturally, this does not mean that we regard our methods as the only right ones. The experiences of various other socialist countries offer very many positive results. In the Soviet Union or the German Democratic Republic, for example, central management and planning play a greater role in setting the directions of technical and technological progress, and also in important questions of realization. Numerous noteworthy results have been achieved with these methods.

It is common knowledge that prior to 1968 technical development was managed by essentially such methods also in Hungary, and we are enjoying even now numerous benefits of that management. Today it nevertheless seems necessary to perfect methods of technical development that conform to our management system. We regard this system as a good one, even though it is not yet working the way we want it to work.

Within technical development, the tasks and responsibilities of the central managing organs and those of the economic organizations differ by branches and sectors of the national economy. It is obvious that in the processes of technical development that enhance the utilization of natural resources or the infrastructure's development, for example, the role of the central managing organs is substantially greater than in manufacturing, where in their turn the enterprises must assume a greater role. We intend to increase the socialist state's role in determining the principal directions and means of technical development, and also take more closely into consideration the requirements that the consumer and the marketplace set for technical development. According to this concept, it is the government's task to coordinate technical development in the various branches of the national economy and to comprehensively regulate activity in a way such that gives the economic units greater independence in performing their day-to-day tasks but expects them to assume more responsibility than in the past.

Practice has confirmed the soundness of the approach that the enterprise's bottom line, its profit, must be the main driving force of technical development; in other words, that economic compulsion must become the vehicle of technical development. This is the direction in which we must proceed also in the future. However, the stimulating effect of the enterprise's profit incentive system on competitiveness, and thereby on technical development, does not assert itself adequately as yet, and also the compulsion exerted by the market is not strong enough. The task then, is to choose our strategy of technical development in accordance with the development of our management system, and with our economic-policy objectives and interests, and to urge the cooperation of the enterprises and economic organizations in the implementation of this strategy, on the basis of their economic incentives. I am convinced that also in the future we must specify in the national economic plan, or in the related

research and development plans, the most important tasks of technical development and the conditions for their realization. Nor can we dispense with central development programs because they have a decisive influence on the entire economy as well as on technical development.

Realization of our objectives depends to a large extent on how we are able to modernize our system of enterprise and state institutions related to technical development. This process has already started with the establishment of research enterprises and with other organizational measures, but further steps are necessary to achieve the closest possible harmony of the incentive system, management system, and system of institutions.

The work of the technical intelligentsia basically determines the success of technical development. In the course of arriving at various political decisions, the party has always paid close attention to scientific research, technical development, and the opinion of creative intellectuals. This is only natural, because it follows from a Marxist-Leninist party's ideology and mission that it cannot dispense with the results of scientific research, the new fruits of intellectual effort, that significantly enhance social progress and the tasks of building socialism. Hence the party has always strived to maintain orderly and fruitful relations with the intelligentsia, and within it with the technical intellectuals who play a particularly important role in the economy.

It is common knowledge that mutual trust and respect link the MSZMP to every social class and stratum, and hence to the intelligentsia as well. We intend to continue in this spirit. The party's relations with the intelligentsia, including the technical intellectuals, are free of political and ideological problems, although lately there have been several comments regarding their financial and moral appreciation.

I, too, believe that the technical intellectuals' financial appreciation must be improved. We all know that during the past decades progress in granting the technical intellectuals financial recognition, in relation to their value-creating activity, has been slower than in the case of blue-collar workers. There are both attitudinal and objective reasons for this. In the past, in my opinion, the technical intellectuals' suitable financial appreciation was hampered primarily by attitudinal factors, but the main obstacle today are the financial difficulties arising from the state of the economy.

It was not by accident that I mentioned attitudinal reasons. For there was a time when the view prevailed that the salaries of white-collar workers must not rise at a faster rate than the wages of blue-collar workers. I fear that many persons support this view even today, but they object that intellectual work is not receiving adequate financial recognition. The standpoint of the party and government on this issue is quite clear. Remuneration based on performance and on the quality of the work performed must be introduced in every area, for white-collar and blue-collar workers alike. But we know that it is very difficult to follow this principle through: on the one hand, the attitude favoring wage equalization still persists; and on the other hand, consistent realization of wage differentiation is a problem amidst rising consumer prices and limited possibilities for granting pay increases.

The tasks in conjunction with improving the financial appreciation of technical experts and scientific researchers are divided between the government and the enterprises. Besides elaborating the general principles and requirements regarding remuneration, the government must make provisions for raising the salaries of the technical intellectuals working for budgetary institutions. At the same time the enterprises must make arrangements for improving the financial situation of the technical intellectuals working for them. The government regularly considers these questions and urges the enterprises to do likewise. I would like to mention, for example, the most recent measures: modification of the salary schedule, higher starting salaries for young experts, development of an incentive system for the research enterprises based on profit and economic efficiency, and the provisions regarding the fees of innovators. Also noteworthy is that the government has recently made possible the gaining of top posts by competition and the introduction of a system under which directors are appointed for a definite period. Furthermore, the government is encouraging the development of personal initiative and is providing new conditions for this. All this offers substantially better opportunities for the advancement of technical experts, and of young experts in particular.

Thus it is evident that we are keeping on the agenda, and intend to broaden depending on what the country can afford, the recognition of the technical intellectuals' knowledge and work. However, the question arises as to what kind of harmony exists between the present level of production and of the products on the one hand, and the number of technical experts, their knowledge and its utilization on the other. I think that everything is not yet in order in this respect. Considering the number of technical experts and their abilities, the ratio of competitive products of a high technological level is still too low. The available brainpower is not being utilized adequately. Therefore it is very important that managers at both the enterprise and sectoral levels see to it that everyone is assigned work befitting his training and knowledge, in which he is able to make maximum use of his abilities.

Allow me to use this opportunity to present some thoughts on the state of our economy and on some timely questions of economic policy. It can already be said of 1983 that we are able to achieve our two main objectives: the improvement of external economic equilibrium, and maintenance of our standard of living. Whereas in 1982 we had a surplus of about 400 million dollars in the balance of our nonruble-denominated trade, our goal for 1983 was a surplus of 700 to 800 million dollars. Because the external and domestic economic conditions are less favorable than expected, it now appears that we will not be able to achieve this goal. However, the foreseeable surplus of 500 to 550 million dollars reflects even so a very commendable performance.

As our most important result we may regard the fact that in 1983 we have been able to remain solvent. Parallel with this, although at cost of some difficulties, we have been able to slightly improve also our domestic economic equilibrium: for example, the balance of the state budget, and the balance of effective demand and market allocations. This is true even if in some instances the assortment of merchandise has been narrower than in the past, because basic supply has remained balanced and normal. Although in the contradictory manner, manpower demand and supply, and equilibrium of the investment market also have improved. So far as the development of the living standard is concerned, I am

able to say that the rise of the consumer-price level will not exceed the 7.5 percent planned, while real incomes--instead of their planned decline--will remain at last year's level. We are achieving these results despite our significant terms-of-trade losses this year in trade with both principal provenances and destinations, and even though the drought has caused substantial losses, not only in agriculture but in the entire economy.

The question arises as to what we may attribute our performance. I would mention as first the country's domestic political stability, in other words the understanding and support that the leadership is encountering from the people throughout the country. Within this understanding and support, of course, there is also growing criticism. But the decisive is the public mood that things could be worse. This reflects not only pious wish, but also the determination of the people, enterprises and cooperatives to do something about extricating ourselves as soon as possible from our difficult situation, primarily through the results of their own efforts.

I find that this year the economic units' initiative and the efficiency of local management have improved. It will suffice to cite the efforts to alleviate the losses caused by the drought. Thanks among other things to these efforts, the losses have been substantially smaller than originally estimated.

A contributing factor to our results has been also continuous and consistent work by the government, reflecting the mentality that inaction amidst the rapidly changing conditions would be the greatest mistake. We commit a smaller mistake when the interests of the national economy compel us to interfere temporarily ~~in the~~ activity of the enterprises, even though we are aware that this is not the ideal practice of macroeconomic management.

Naturally, this year has had also its dark sides. For example, we have been forced to continue the curtailment of capitalist import, which in some instances hampered not only continuous production, but also the expansion of export. The improvement of economic equilibrium has been influenced by the fact that this year we have again been unable to curtail investment as planned.

The forced interferences in the economic processes during the year have not been free of problems also in other respects. We know, for example, that the enterprises which started major investment projects in recent years are in a very critical financial situation because interest rates have risen in the meantime. However, macroeconomic management must make a distinction between the enterprises in such a situation, and the ones that are undercapitalized or are showing a loss through their own fault. These are two distinct categories, two cases of a different nature, and therefore they must not be confused and cannot be treated in the same manner.

In relation to the category of enterprises whose financial difficulties have not been caused by investment projects and higher interest rates, we must set stricter requirements, and both the government and economic management must be more consistent. For the solution is no longer practicable of withdrawing profit from efficient enterprises in order to rescue the less efficient ones. The socialist state cannot become a refuge for permanently lagging economic units. In Hungary we do not have to fear that reorganizations of enterprises that

operate at a loss or at low or inadequate efficiency will leave the workers unemployed. State intervention in the situation of such enterprises in our country does not create social tensions that cannot be resolved; therefore in such cases we must not show excessive tolerance in the course of reorganization. We know that we do not have as yet sufficient experience in solving problems of this type, but this cannot serve as reason for sweeping the problems under the rug.

Among the dark sides I wish to mention the forced price increases. We said that in 1983 we would not raise the centrally controlled prices of basic commodities. But we also said frankly that this promise could be kept only if external circumstances beyond our control would not force us to act otherwise. Unfortunately, the well-known objective reasons have compelled us to introduce price measures that depart from our original intentions.

The economic-policy objectives and requirements of the 1984 plan are now being formulated. On the basis of the work to date it seems that we will have to retain the earlier priorities for next year as well. We have no meaningful choice but to assign top priority to external financial equilibrium, to the preservation of our solvency. We must derive from this requirement all our economic tasks, in production, investment and distribution alike.

For a long time to come, our most important task will be to gradually reduce the foreign debt we accumulated during the past decade. This will require gigantic effort. In the opinion of many economic experts, the burden of the debt accumulated in the 1970's is greater than the losses of the 1929-1933 world depression or the economic losses of World War II.

There are views to the effect that in the world economy changes are unfolding which will be favorable for us as well. However, the economic upturn that is perceptible in the United States is barely spreading to Europe where our principal markets are. Thus we must be prepared to wage in 1984 the economic battles for our survival under conditions that will remain unfavorable from our point of view.

I find it necessary to call attention to the fact that maintenance of our solvency is not merely a financial question. A country can become insolvent in more ways than one. It can happen when a country becomes unable to pay; in other words, for economic and monetary reasons. But it can also happen when a country's domestic political stability breaks down. Thus we must solve our problems in a way that will enable us to preserve our most precious political capital, our balanced domestic conditions.

The question often arises as to whether the economic-policy requirement of protecting the standard of living is still valid. Primarily real wages, real income and personal consumption are mentioned in this context. These are undeniably the living standard's decisive factors but do not exhaust all its factors, the development of living conditions, for example. Not only our income and consumption determine our living standard, how well we are living. Several elements of our life-style cannot be quantified, yet they do exist and influence the quality of our lives.

We often forget about these factors and elements, and yet they too are a part of our lives. Those who are familiar with our political practice know very well that preservation of these achievements is of very great importance.

Nor should we forget that we are spending 180 to 190 billion forints a year on investments, about a third of which is for the development of the infrastructure that directly influences the population's living conditions. For example, 75,000 housing units are being built a year, and the conditions of providing educational and health services are constantly improving. Everywhere the country is undergoing construction and improvement. From all this it is evident that we are maintaining our society's achievements in spite of our problems, and are improving the population's living conditions to the best of our ability, but we cannot undertake to do more under the present conditions of the world economy. We may be proud of our results, but we must not be complacent. We must see to it that the preservation of our achievements remains the centerpiece of our policy.

It is already the fifth year that we are pursuing in practice our present economic policy that aims for economic stabilization and consolidation. It has produced such significant results as, for example, an expected trade surplus of about 0.5 billion dollars in contrast with the 1.2-billion-dollar trade deficit in 1978, and in nonruble-denominated trade a 30-percent expansion of export at a 10-percent reduction of import. A practice has evolved that significantly reduces the economy's operating costs, including the consumption of energy and materials. We have encouraged the unfolding of intensive economic development and have begun to modernize the system of macroeconomic management.

Five years are sufficient time to evaluate also the weaknesses and shortcomings of this period. Outstanding among them has been our ability to restore equilibrium only at the cost of substantially curtailing domestic demand. For in changing our product mix and improving our competitiveness we have not yet been able to achieve results that could enable us to strengthen our market position and accelerate our economic growth. In this respect the technical intellectuals, too, must exercise self-criticism. Another problem is that the most profitable enterprises must assume the greatest burdens and sacrifices for the restoration of equilibrium.

Our present equilibrium is obviously rather fragile. Thus we must create the conditions for a period of more dynamic development, one in which we can establish more stable equilibrium through the expansion of supply. For this we would need also additional resources. Under the present conditions in world politics and in the world economy, however, we cannot realistically expect to obtain substantial additional external resources. Nor can we expect to accelerate our economic growth through a significant expansion of our natural resources. However, we are able to meaningfully improve the efficiency of forming and using our domestic resources. We must improve the value-creating activity of Hungarian industry, agriculture and the economic units, through an economic policy that promotes this in every respect.

In view of the fact that in the external conditions we cannot expect radical changes for faster economic growth and the more intensive development of the

national economy, we must proceed along the new path of economic dcevelopment by relying on our own potential. This is also why we are modernizing our system of macroeconomic management. In the course of this the modernization efforts center around the enterprise, so that the quality of the enterprises' activity and their income-generating capacity may improve significantly, relations between the enterprises and the managing organs may likewise improve, and the market's production-influencing function may assert itself better. Economic management's this type of modernization and functioning necessitate that a favorable political climate, at both the macroeconomic and microeconomic level, a modern economics approach, initiative and disciplined human behavior enhance the unfolding of the processes.

I hope that the Federation of Technical and Natural Science Associations and its members will continue to aid successfully the realization of our economic and social objectives, and to foster our progressive traditions that have been established by such outstanding personalities as Andras Jendrassik, Tivadar Puskas, Donat Banki, Gyula Hevesi and all those who have enhanced the reputation of Hungarian engineers not only at home but also abroad.

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WORK OF BIOLOGICAL RESEARCH CENTER HIGHLIGHTED

Budapest NEW HUNGARIAN QUARTERLY in English No 92, Winter 83 pp 103-108

[Text]

Some of the most promising research in Hungary today is taking place at the Szeged Biological Research Centre of the Hungarian Academy of Sciences. Rumour has it that the scientists work here in an atmo sphere which is more than agreeable for this reason. I was naturally more interested in the atmosphere research is carried out in than in the research itself. My questions were answered by Dr. Lajos Alföldi, Director General of the Centre, with and by the participation of Gabriella Lázár, scientific secretary of the institution.

What led up to the establishment of the research centre here? In Hungary, most cultural and scientific life is concentrated in the capital. What lay behind the decision to locate this institution in Szeged?

In the fifties biology as a science took off all over the world. I can mention some of the revolutionary discoveries: the role of DNA molecules in carrying genetic information became obvious. The structure of these molecules as well as the mechanics of genetic information became known. Exploring the regulatory functioning of the genes also became possible. The knowledge derived from this revolution called molecular biology reached Hungary too, but it took a long time for decisions and plans to come out—the mid-sixties in fact. At that time government policy was to decentralize industry and research. Szeged had an advantage over other country towns: the only Hungarian Nobel prize winner—out of so many—who received his prize for work which he did in Hungary itself, Albert Szent-Györgyi, did his research into biological oxydation and later on into the functioning of the muscles here in Szeged. (Incidentally, he was present at the opening of the Centre.)

Szeged has a good background in medical biological research, and there was a tradition in classical biology in the Szeged University of Sciences. Szeged is a university town with first-class medical facilities and clinics: so it could be expected that some of the research staff would be available here, as well as new generations of researchers. Of course, it would have been impossible to acquire all the researchers who today work here, from Szeged alone. About one half of our 130 research staff are graduates of Szeged University, approximately 20 come from Budapest, and the others moved here from other parts of the country. From the beginning, we had 120 flats, which made it possible to accommodate visiting researchers.

Earlier you mentioned the new school of biology. Tell us some more about it.

New biology is interested primarily in the structure of genetic information, how it manifests itself and in its regulatory mechanism. This covers in essence all aspects of the functioning of cells, from metabolism

through cell-division, the process of differentiation to the functioning of the nervous system.

It is hardly likely that all this can be undertaken in a single research institute. What is the Szeged Biological Centre primarily engaged in?

The Szeged Biological Centre consists of the Biochemstry, the Biophysics, the Enzymology, the Genetics and the Plant Physiology Institutes.

Our function is to conduct basic research whose results can be applied in agricultural and pharmaceutical research.* Certain problems of regulation are dealt with in all five research institutes. The regulatory problems that interest us are those in the manifestation of genetic information, in the functioning of protein on the molecular level, and in the whole cell.

What is the standing of this work among research institutions in the world?

The problems I have just described are problems which are also dealt with at the top of the profession internationally. We publish our achievements in periodicals which represent a powerful filter, as it were, a measure of value. We also observe the reception of our publications. I believe that we are already being taken notice of, but this is far from meaning that we are at the top internationally.

Can a sort of sudden arrival at the top be imagined bearing in mind that you start with a much narrower financial base and far fewer professional traditions?

It is possible but not probable that a Hungarian researcher could achieve some outstanding result of worldwide importance. Even today, in the era of research teams, luck still plays a great role. But where do the breakthroughs occur? Where research has a considerable tradition. Many of us publish in leading foreign periodicals. But our background is still narrow. The biology textbooks of the world would certainly not change if our achievements were omitted.

* See *NHQ* 86, 89, 90, 92 (In Focus)

But we have obtained one or two results which are cited very frequently. — Biologists expected, but had not yet succeeded in confirming experimentally what was first proved in our Centre: if we change the genetic substance of a somatic cell of the plant in a test-tube, and bring up a plant out of it, not only every somatic cell of the new plant will be mutant, but its pollen too. The somatic mutation has proved to be transferable to the germ line, which has proved that the genetic information referring to the entire plant is present in the somatic cells too, that is, not only in the gamogenetic cells. Another thing which attracted great attention was that one of our research teams proved that it is possible to bring about a hybrid of the carrot and of the human cell, and that this even shows symptoms of life for some time! It was found that there was no fundamental incompatability between the building stones of the two organisms. This achievement of ours is one of the telling proofs of the partial compatibility of living organisms on the cell level. In the new biology living materials of a higher or of a lower order do not exist.*

What sort of finances are available to the centre, bearing in mind tremendous costs of research?

* The most frequently cited publications emanating from the centre are:

Maliga, P., Breznovits, A., Márton, L.: Streptomycin resistant plants from callus culture of haploid tobacco. Nature New Biol. 244: 29–30 (1970).

Dudits, D., Raskó, L., Hadlaczky, Gy., Lima-de-Faria, A.: Fusion of human cells with carrot protoplasts induced by polyethylene glycol. Hereditas 82: 121–124 (1976).

Fodor, K., Alföldi, L.: Fusion of protoplasts of Bacillus megaterium Proc. Nat. Acad. Sci. USA 73: 2147–2150 (1976).

Kondorosi, Á., Kiss, Gy. B., Forrai, T., Vincze, É., Bánfalvi, Zs.: Circular linkage map of Rhizobium meliloti chromosome. Nature 268: 525–527 (1977). Boros, I., Kiss, A., Venetianer, P.: Physical map of the seven ribosomal RNA genes of E. coli. Nucleic Acids Res. 6: 1817–1830 (1979).

At the start we obtained considerable financial assistance from the United Nations Development Programme, but the foundations for our work are provided by the state budget. In addition to this we have support from various sources (primarily from the National Technical Development Board) which is directed at particular research topics. Another important source of funds is our income from contract work which we mainly carry out for industrial and agricultural enterprises.

Our institute's equipment is up to contemporary requirements, and our funding is adequate for our work. However since the forint is not freely convertible, there is no disguising the fact that purchasing instruments, equipment and material from Western sources is a serious burden. Despite the limited amounts available to us, we still manage to run an international post-graduate course, where we are able to cover the living costs of fifteen to twenty young foreign graduates annually and they mainly come from the developing countries.

People engaged in research tend to gravitate to the most developed countries. Have you lost any of your research staff in this way?

Well, our actions over twelve years prove that we have set ourselves the goal of making foreign travel possible to the largest possible number of our researchers. At the moment we support 200 trips annually, and only once in twelve years have we not provided support for a research trip abroad. Most of our researchers go abroad with their families, and out of 1500 research trips only five people did not return. I believe that of the same number of people going from, say, Western Europe to the USA, at least the same number, if not more, would not return. Most of these trips are for a long period. When they are abroad our researchers work and publish. Out of our researchers 28 are at present on study trips abroad involving a stay of one year or longer.

Let me turn the question around this time: what does the foreign research gain from a Hungarian visitor?

The host professor may give one of his problems to the young Hungarian to solve. Our foreign partner is sure to obtain a good collaborator, a reliable and highly trained research worker. I might also add that he obtains these services much more cheaply than he would for a collaborator of the same quality of his own nationality.

The elder statesmen of international science travel a lot. Are you ever visited by any of these famous foreign scientists?

In the last three weeks alone we had the following visitors: the Nobel Prize winner Sir Andrew Huxley, who is also President of the Royal Society, Sir Arnold Burgen, the Foreign Secretary of the Royal Society; and Dr. Ronald Keay, Secretary General of the Royal Society. We also received a delegation from the Swedish Royal Academy which included Professor Caspersson, Professor Scheler, President of the Academy of Sciences of the German Democratic Republic was here as well. And a delegation from the Soviet Academy of Sciences gave us the opportunity of welcoming Academician Baev, one of the truly great figures in biotechnology.

Even when we were setting up the Centre we all were of the opinion that Central European, or more exactly the Hungarian tradition in science, is one of strict hierarchy. It is Professor Bruno F. Straub who has done most for the Centre since its foundation, first as Director General, and today as the Director of the Enzymological Institute, to ensure that this was a tradition we did *not* follow. In the international field, competitive research cannot be done with that attitude and organizational principle! Consequently it was our aim to avoid this organizational structure, one which used to characterize Hungarian research establishments and indeed is still characteristic of some of them.

The most important person at our Centre is not the director but the researcher. It is

not the directors but the heads of the individual research teams who select their collaborators and allocate the money available. Every year, on the 24th April, anybody may leave his or her research group without having to give any reason, join another research team, or start independent research. It can happen that in this way a research team becomes depleted or ceases to exist within a few years. Its head may be an excellent scientist, but he has not treated his collaborators well.

Another way of avoiding ossification is that here nobody has a permanent job, everybody is under contract. This goes for the position of Director General too—the five directors of our five institutes fill the position of Director General in turn.

Our library is perhaps the only one in Hungary where the stock is completely accessible and can be used at any time, day or night.

Those who leave us find that the style of work to which they have become accustomed here, the frank speech, use of first names by everyone in the centre and so on creates something of a shock elsewhere, and leads to antagonism. Those whom we ourselves ask to leave, are given sometimes three four or even five years to find another job. They are not bad researchers either, but—speaking figuratively—we have decided they will not make finals of the World Cup. But they have every chance of working very successfully and happily with some other institution.

In our Centre we do respect one form of hierarchy: from time to time we prepare and put into our library the ranking list of the citations of publications by our researchers, on the basis of the scientometric citation indices. A good position in this order may be the strongest argument for somebody to obtain more money for his research.

That the Centre was able to start something new in Hungarian science since it opened in 1970 —this could have something to do with the fact that it is far from the majority of research institutes concentrated in Budapest. But I am certain that being in the country sometimes has its drawbacks.

Of course we must accept the fact that in Hungary everything continues to be centred in the capital. That is where we must make most of our purchases, where the superior authorities reside, and where all sorts of conferences are usually held. This also means that heads of teams and the senior researchers often spend an entire day in Budapest on affairs and participating at conferences which take up only one or two hours of the time of those who work in Budapest itself.

Hungarian science is under the central direction of the official and scientific bodies of the Hungarian Academy of Sciences. How can this central direction be reconciled with your work which is based on a free spirit and individual initiative?

Yes, we too must draw up five-year plans. The director of each of our institutes draws up a broad programme and strategy for his area of research. The research teams try to set themselves concrete tasks which are both attractive to them and can be fitted into the broad programme. Here experts have to argue with experts. They convince each other, they reach agreement: this is how the programmes of the working teams are prepared. But these too represent only a tendency. Having put the plans together appropriately, we send them to the official and scientific bodies of the Academy, who in turn give us their opinion on them. If one of the bodies opposes some detail of the submitted plan, a heated debate follows, in which usually the expert wins. But in this case the expert bears the entire risk and responsibility. As far as individual initiative is concerned, we in our institution have a single criterion: success. I can safely say that everybody works on what obsesses him—provided that this obsession proves to be successful. If it is not successful, it can nevertheless be continued but with minimal institutional support. In an organization

oriented towards achievement, as ours is, one can only proceed in accordance with the biblical saying: unto those who have it—support shall be given, and from those who have not—success—it shall be taken away!

Do you think that the very considerable expectations aroused by modern biology have been fulfilled?

I believe that they have, yes. The revolution in biology in the fifties has been carried on in the past quarter of a century. And in an unexpected direction, towards genetic engineering. This has made possible the achievements and approaches to problems which could not even be imagined at the time. For instance, the DNA "thread" can today be cut up at will by biochemical methods, or the pieces can be stuck together, pieces can be introduced into other organisms, and we can even have information expressed there. For instance, the production of human insulin can today be entrusted to bacteria. Since January 1983 human insulin produced by Ely Lilly through bacteria has been distributed in the United States.

But for some time worried voices have been raised about the possible dangers in this tremendous development.

I do not want to play this down but remember that a tremendous fire can be caused by a match. Many biologists do indeed think—and I believe justly so—that their responsibility towards society demands that they should also investigate the consequences of their experiments. This is why they proposed when work began on genetic engineering that a voluntary moratorium should be held, and the risks of these experiments be investigated. They thought, for instance, that building the genetic substance of a tumor-causing virus into a bacterium was extremely dangerous and might have unforeseeable circumstances if such a bacterium escaped from the laboratory.

However, it was soon found out that these fears were exaggerated and most experiments could be continued without any danger, if only because the expression of genetic information is more complicated than the reasoning behind the books written about the dangers of the biological revolution. In the case of most implantations thought to be dangerous, the universal characteristic of the artificially produced cells asserted is that they are not viable by themselves, in other words they need special endeavours to keep them alive. Far from causing any trouble, they simply perish if they get out of tho test-tube. Remember that the product of a chicken factory, the battery chicken cannot be kept in a poultry yard either, it is viable only in artificial circumstances. I believe that the sounding of the alarm bells was on the whole exaggerated.

Let us imagine that biological research stops. Is not the knowledge we have accumulated sufficient?

Sufficient is a relative notion. As an expert I believe that what we know about the living organism is still less by orders of magnitude than what we do not know.

The aim of research is to know the unknown. Everybody accepts this argument until it affects his pocket. But where would mankind stand today if man had not used the grey matter of his brain? Science is necessary just as any other form of human self-expression is. I believe that civilization does less damage to society than the improvements it adds to it. Sometimes it has to repair the damage it causes. A hoe sometimes removes a useful plant, yet hoeing is worthwhile. But the most important reserve to our power may be the not altogether consoling observation of Monod's—the world is not for man, but for itself; man is but a fortunate mutant in the living world. In certain areas he is competitive with other species, but he is also a detestable being, because the condition for his success has been up to now his aggression, his destructivity even when it makes no biological sense. The task is clear though difficult to carry out: he must survive successfully while ceasing his destruction.

Lately there has been some scepticism on science. There is no longer as much hope and trust in the power of science than there was earlier, even ten years ago. Why do you think this is?

Armies would more surely deserve mankind's distrust and yet there is more talk about the disillusionment caused by the sciences (I am not talking of disillusionment on the part of the scientists but of the public. I imagine that one of the reasons for this antagonism to science is that researchers do not play sufficient attention to their image in public opinion). Science has no organization which looks after its public relations. Everybody is occupied with his own reputation, but science as a whole does need some advertising, some publicity in the good sense of the word. The situation is made all the worse for the current bad economic conditions. The funds devoted to science are reduced sooner than those to other areas. As basic researchers we can say that our research will certainly bring success, but we always and only can use the future tense when we say this. The authority of science was romantically high world-wide, and perhaps this is a reason why ideas on science have changed, its authority has diminished. I see no tragedy in this. Let us accept the fact that science has no cure for all ills, and especially not immediately. I do not even expect public opinion to place trust in science. I desire only that it should accept science as a necessary occupation—just as it does coal-mining or the theatrical arts.

MIKLÓS HERNÁDI

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PERFORMANCE OF 'MEGA-MINI' COMPUTERS COMPARED

Budapest SZAMITASTECHNIKA in Hungarian Nov 83 p 5

[Article by Csaba Gergely and Balint Andrasi: "A Performance Study of 'Mega-Mini' Computers I"]

[Text] Parallel with its growing tasks the financial information system (PIR) must expand the resources which can be used to carry out the tasks. According to the conception which was developed the inventory of equipment is put into a three level hierarchy. Between the lower level (work site simple or intelligent terminals, personal computers) and the upper level (large computers serving a national hook-up) they have been using devices based on minicomputers (concentrators, multiple function input-output computers). Because of the capacity limits of these they have not been able to relieve significantly the burden on the large central computers in batched mode procession of large volumes of data and they were not suitable for the development of local data bases and transaction processing systems.

Since there are well known limits on expanding the capacity of the large central computers it would be desirable if the performance of the devices in the middle level of the hierarchy (at the county organs of financial administration and in the financial institution data processing systems) were better than at present, if they could serve one or more information sybsystems in an autonomous way in both the local batched and transaction processing modes. (Naturally, the requirement of on-line communication with the lower and upper levels of the hierarchy still maintains.)

With a further development of earlier minicomputer products the domestic computer technology industry has been offering for several years devices which can be ranked in the "mega-mini" category--thanks to their storage structure and processor performance. On the basis of their basic hardware parameters the user seeking a device could hope that these machines might offer significant processing capacity, perhaps even comparable to the small-to-medium machines of "traditional: computer technology--characterized, for example, by the ESZR [Uniform Computer Technology System] computers. More concretely, in the case of the PIR, he could hope that they would meet the requirements made of the middle level of the hierarchy.

Before making use of these devices one must convince oneself by objective methods, naturally, of the extent to which these expectations are well founded, how the "raw hardware" performance will be realized in what will continue to be a mini-computer architecture and software environment. Studies in the interest of this have been conducted for some time already at the PSZTI [Ministry of Finance Computer Institute] (in cooperation with the KSH [Central Statistics Office] SZAT [Society for the Development of Computer Technology Applications]). At first these extended to the batched mode in various programming language environments; this was followed by a study of the possibilities of on-line data base management and transaction processing. We carried out or are carrying out the measurements on the available domestic "mega-minis," the VT600 and SZM52 and the TPA 1140/1148 computers, in the MTM2 or RSX11M operating systems with the data base management and transaction software tools of these in such a way that where possible we can make comparisons with the performance of traditional, ESZR compatible computers. When defining the measurement program and when conducting the measurements we naturally cooperated with the manufacturing firms; indeed, some of the measurements were done on configurations made available by them.

In our present article we will try to describe the methods and results of our studies of performance relationships in the batched mode; we will devote our next report to experiences acquired in the area of data base management systems.

We had two goals with the benchmark measurements done in the batched mode, in the first place to prepare for the selection of the computer model and configuration and in the second place to collect performance data for future system design work. We measured the performance of the machines or systems as they would appear to the average user, as the performance of high level languages and services.

About 90 percent of the programs written at the PSZTI thus far have been prepared in the COBOL language, thus we organized our studies primarily around this language. We selected PASCAL as the other language to be studied in more detail, as this is one of the most extensively used high level languages for mini and microcomputers. We also did studies on other languages, not fundamentally essential for us from the applications viewpoint, for a better performance characterization of the computer systems (CDL2, FORTRAN).

We ran the measurements in the systems in a monoprogrammed local batched mode. The synthetic benchmark programs realize elementary operations which can be regarded as characteristic of data processing. The measurements can be grouped in the following way:

--A study of the speed of the central unit, of the efficiency of the high level languages. We prepared two types of measurement programs--a program for store sorting and a program for matrix inversion. The store sort is a two pass sorting of a 100 element block with the so-called "bubble"

algorithm. We wrote this program in CDL2, PASCAL, and COBOL. The measurement done in CDL2 can be regarded as the datum characterizing the speed of the hardware, considering that in addition to good carrying capacity the CDL2 has code optimization and a good software/hardware interface.

The measurements done in COBOL with various data depiction modes characterize the decimal arithmetics simulated in hardware, firmware or software. To evaluate the results it must be noted that in general the COBOL interpreters in mini-computers generate an intrpretative code from the source program, due to the limited logical address range (in general 64 K bytes). A virtual machine realized as a dispatcher system executes this intermediate code. In the SZM52 computer this dispatcher system is realized in the firmware. We prepared matrix inversion to study the speed of floating point operations.

--A performance study of magnetic disks. The hardware available fundamentally determines the I/O performance (for example, the SMD compatible disks of the TPA 1148). The performance influencing effect of the software appears well with serial data files, comparing measurements done in the COBOL and PASCAL languages or the central unit operation ratio of I/O intensive COBOL programs. Of the languages studied COBOL offers the most convenient file processing services; naturally this has a "price."

--A study of sorting programs. Sorting files is one of the characteristic tasks of data processing. We studied this important service with a special series of measurements, taking care that the results should be comparable. We carried out the sort on every machine on one disk (because of configuration limitations); better results could be obtained with several disks and good file distribution.

--A study of a program system carrying out a real task. Not primarily for measurement purposes but rather to study the possibilities of program and file conversion we ran the Financial Auditing System (PUR) on the machines. We had the following viewpoints in selecting the system:

--the programming level should be regarded as average,

--it should not use environment specific services (for example, a data base management system), and

--it should not be a large system but should contain a sufficient number of programs and data files.

We made no changes in the operation of the programs in the course of carrying; we only carried over the syntatic differences among the various COBOL representations. We did the PUR measurements on a SIEMENS 4004/151 computer, so when evaluating the results it must be remembered that this machine represents a higher performance catagory than the ESZ 1022 category 4004/45 chosen as a reference.

Table 1. Hardware-Software Environment of the Measurements

Parameter	SIEMENS 4004/45	VIDEOTON ESZ 1011/ VT600	VIDEOTON SZM52	KFKI TPA 1148	Units
Central storage	256	1024	1024	512	K bytes
Store cycle time	1.44	0.6	0.6	0.6	micro s
Address arithmetic	18	20	20	22	bits
Decimal arithmetic	yes	no	yes (1)	no	
Floating point arithmetic	no	yes	yes	yes (2)	
Capacity	50	50	50	80	M bytes
Transmission speed	312	312	312	1200	K bytes/s
General positioning time	35	35	35	30	ms
Sector size	(3)	256	256	512	bytes
Operating system	BS1000 V1.4(4)	MTM2 V3.1	MTM2 V3.1	RSZ11M V3.2	
COBOL standard	ANSI 68	ANSI 74	ANSI 74	ANSI 74	

1. The SZM52 contained the so-called "COBOL operator" card, which is a microprogrammed realization of the COBOL dispatcher system. In addition to decimal arithmetic operations it supports the execution of COBOL programs in general also.

2. The computer (FIS) contains an expansion realizing the four basic operations.

3. Band organization disks.

4. An operating system comparable to the ESZR OS/MVT.

Table 2. Summary of the Measurement Results

Test: Language or parameter	SIEMENS 4004/45	VIDEOTON ESZ 1011/ VT600	VIDEOTON SZM52(1)	KFKI TPA 1148	Units
Store sort:					
CDL2	n.a.	2.3	1.1	1.2	s
COBOL fix p binary	8	188	40.8	23	s
COBOL decimal	17	172	35.5	36	s
COBOL packed dec.	17	144	(2)	69	s
Pascal	n.a.	5	n.a.	9 (4)	s
Matrix inversion:					
FORTRAN	440	224(3)	n.a.	183	s
Pascal	n.a.	129	n.a.	326(4)	s
Sequential file processing capacity:					
COBOL	72.4	58.5	58.0	185.2	records/s
Pascal	n.a.	217.4	n.a.	344.8(4)	records/s
COBOL relative file management:					
Processing capacity	16.8	18.3	17.5	31.8	records/s
1% access time	5.9	5.4	5.7	3.1	s
Direct processing limit	42.7	28.5	30.3	26.2	percent
COBOL indexed sequential file management:					
Processing capacity	6.3	6.1	5.2	11.1	records/s
1% access time	15.8	16.4	18.4	9.6	s
Direct processing limit	27.0	14.9	6.8	11.1	percent
(unlabelled row):					
CPU operation ratio of I/O intensive programs	(5)	47.9	8.4	19.6	percent
SORT:					
Minimal store size	10.7	12.8	n.a.	19.6	records/s
Maximal store size	76.9	12.8	n.a.	64.5	records/s

Table 2. (continued)

PUR:					
total running time (9 programs)	515.0(6)	11547.0	n.a.	4047.1	s
Average running time (1 program)	57.2	1649.6	n.a.	578.1	s
COU intensity	27.8	82.6	n.a.	35.4	percent

1. A machine equipped with the older version disk control is about 20-40 percent slower than the control of the ESZ 1011/VT600.

2. Could not be measured due to microprogram error.

3. Repeated measurement in the 4.0 version gave a substantially better result (77 seconds).

4. Data measured with the OMSI-1 Pascal version (gives substantially better running times in the MOSI-2 version).

5. Could not be calculated; running time without I/O operations fell within the order of magnitude of measurement precision.

6. Data measured on the SIEMENS 4004/151 machine.

On the basis of the results--even if they are not complete for every measurement for technical reasons--we can say in summary that the batched mode performance of the "mega-mini" computers approaches or is comparable with the performance of the category represented by the SIEMENS 4004/45; indeed, in some cases they give better results--depending on the task and program language. On the basis of the carrying experiences with the large computer system, however, we do not consider it appropriate to take over systems running on a large machine without re-design.

It must be noted that both "mega-mini" operating systems used (MTM2, RSX11M) are intended to support conversational or real time processing, as opposed to the "traditional" batched mode possibilities of BS1000. Real time (transaction oriented) tasks will be of increasing importance among the applications planned in the PIR. So it is necessary for us to turn our performance studies in this direction also.

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GOALS OF SPACE IMAGE PROCESSING IN MAPPING

Budapest SZAMITASTECHNIKA in Hungarian Nov 83 p 9

[Article by Engineer Lt Col Sandor Balla and Engineer Lt Col Dr Sandor Szilvasi: "Automated Processing of Cosmic Information in Cartography; Thoughts and Experiments"]

[Text] Photographs made from various space devices, images recorded, stored and transmitted electronically and other forms of remote sensing data are providing large volumes of information. This information is "hidden" in the emulsion layers of space photographs, in the more or less darkened silver particles, or in the smallest electronic elements of the "picture" transmitted to earth stations and recorded on magnetic tape--in the picture elements or pixels, or more precisely in the geometric and physical relationships, ratios, structure and texture of these.

Reading or interpreting pictures or electronic data prepared at a height of several hundred kilometers in the traditional way (with the naked eye, with magnifiers, with phorogrametric instruments and devices) is no longer satisfactory because this reveals only a small fraction of the mass of information in the pictures. Today it is the application of computer technology which promises the most for the solution of research tasks in natural resources and for cartography in the area of processing cosmic information. The development of a picture processing device system and the creation of the necessary mathematical apparatus began long ago in the Soviet Union. This work is proceeding with ever greater intensity--with the multilateral cooperation of the socialist countries.

Processing Space Photographs

The processing of cosmic photographs can be broken down into several basic motifs. In our case the initial basic material for picture processing is the high resolution space photography prepared on Soviet space devices and the data on associated radiation physics characteristics. The pictures prepared on Soviet space ships and space stations are real photographs; they are prepared by optical means in the form of snapshots on special film. These photographs are accurate survey pictures because the

geometric characteristics and data for creation of the pictures are known, so they can be used very well for demanding cartographic tasks. The photographs and other auxiliary tone and graphic data, the maps, must be transformed into numeric data; that is, they must be digitized.

The video information thus created may still contain distortions, especially from the photometric, radiometric and geometric viewpoints. These must be eliminated prior to real processing (analysis); that is, the data must be normalized. It is a condition for this that the necessary radiation data be available. For example, a so-called digital terrain model of the given area is indispensable for the geometric correction; this gives the height above sealevel of every single element (pixel) of the photograph. One also needs the various internal and external orientation data which give the precise spatial position of the space photograph at the moment of exposure--the momentary inclination values of the plane of the film, the deviation of the optical axis from vertical, etc. We must calculate these values prior to normalization. Then we carry out a precise geometric transformation using adjustment data defined by geodetic or geographic coordinates stored in the data bank, carrying out an automatic matching of multispectral digital pictures.

Now the information no longer contains positional distortions. In this way one can determine precisely where the object or phenomenon designated by a pixel or group of pixels is in space.

The next motif is to identify the object whose position in space we now know precisely. This recognition process consists of carrying out an automatic, multispectral interpretation and classification and of an automatic interpretation of the results.

The central motif of picture processing is an analysis of the data obtained. This requires a mathematical modeling of the natural or economic processes or phenomena. We use all the parameters, defined goals, limitations and criteria stored in the available data bank. Alternative variants, prognosis data and prognosis maps are prepared.

The final mass of information reaching the desks of highest level planning and leadership is made up of all these comparisons and evaluations.

The first step of our research work aimed at cartographic use of picture processing was to solve the geometric normalization of space photographs.

As a second step we are trying to carry out photometric normalization, because only in this way will it be possible to obtain the maximum amount of information from the very small space photographs (1:1,000,000) in the form of detailed photo maps (1: 50,000).

We should note that even earlier--in 1979--we succeeded in developing a technology with which we were able to eliminate the geometric distortions of a space photograph with our traditional photogrametric instruments

(in an analog way), or to decrease them to such a degree that they satisfied the precision requirements of precision cartography. This is how we prepared the 1:200,000 scale map called the cosmo-photo map. Every single element of this map, which can be used in many ways, had a positional precision of 0.25 mm (!).

But we could not reach a scale of 1:500,000 in this way, because the space photographs could not be enlarged further in a useful way. At this scale an enlargement of the highly sensitive emulsion film (with large silver particles) fell apart (became "grainy") and significant quantities of information were lost. For this reason we are doing the 1:50,000 processing of the space photographs with the aid of a computer, with a digital procedure.

We began our research and development work with the material support of the National Technical Development Committee (OMFB), using Soviet space photographs, on a picture processing system under development on a commission from the OMFB.

The space photographs are made in an optical way at a height of 220 kilometers--in three different bands of the electromagnetic spectrum. Two of the three bands are visible and one is in the near infra range. The pictures are 18 by 18 centimeters and the focal distance is 200 mm. Thus the approximate scale of the photographs is 1:1,000,000. One triple photograph covers an area of more than 32,000 square kilometers, equal to more than 80 map segments at a scale of 1:50,000. (Such a segment depicts an area of nearly 400 swuare kilometers.) Use of them was aided by the fact that the space photographs were prepared with a 60 percent overlap, which makes possible the production of stereoscopic pictures of the terrain model also.

Digitizing the Space Photographs

We digitized the continuous tone space photographs on a Colormation-4500 device used by the Geodetic Institute.

The digitizing must be done for every image of the multispectral channel. This would be more than 620 million points. At the moment it is not yet possible to handle and process such a large volume of data all together, at once, with domestic devices available to us. So in our first experiment we digitized, in a photograph and on all three channels, a 2X2 cm^2 area (picture) corresponding to a map segment--at a scale of 1:50,000. We got approximately 2.5 million pixels per window. This is a volume of data which can be handled well in practice on the machines available to us.

Parallel with the space photographs we also digitized the planimetry of the map segment covering the area of the window. Since we did not yet have a digital terrain model we selected a test area embracing the window which can be regarded as nearly flat, in an area lying to the east of Lake Balaton.

On both the space photographs and the planimetric map we designated additional adjustment points, making possible a later check, which we designated on the photograph precisely with a photogrametric precisioning instrument. In general these adjustment points can be corner points which can be identified well on the map also.

We measured precisely the geodetic coordinates of the identified points from the largest scale map available to us, and gathered the coordinates into a catalog. The digitized space photographs on magnetic tape were displayed on the screen of the monitor of the picture processing system. Placing the "cursor" automatically on the designated adjustment points, we read and cataloged the so-called pixel system coordinates of the space photograph adjustment points, so that we knew into which row and column of the matrix, consisting of 2.5 million elements, the adjustment points fell.

Thus, each terrain adjustment point now had four coordinates--one in the cartographic (geodetic) system and three in the pixel systems of the three--seperate--channels. If at the moment of exposure the optical axis of all three cameras had been perpedicular to the surface of the earth, regarded as horizontal, then the three space photograph segments would be adjusted to the map by simple magnification--on the basis of the adjustment points. In practice, however, this is never true, because the space device carrying the cameras is subject to constantly changing influences, indeed, the three optical axes cannot even be regarded as entirely parallel to one another. Thus all three pictures suffer varying degrees of so-called perspective distortion. We must eliminate the distortions by a transformation of the entire picture. We have to transpose every single pixel to where it would have been if the camera axes had been perpendicular to the surface of the earth.

In the first case we used four adjustment points for each channel to get the transformation. The essence of the task here is that since the computer "recognized" and covered the approximately selected four adjustment points in the space photograph with the aid of the four adjustment points of the cartographic system it put the other 2.5 million space photograph pixels in the proper position.

We created a mathematical model for this picture transformation and the software necessary for its operation.

With total transformation of the three channels we produced a color picture version or color composites suitable for interpretation on the screen. This changed the space photograph into a precise, multispectral digital cosmophoto, making it suitable for the solution of 1:50,000 scale cartographic and resource research tasks.

In the course of the transformation thus far we have regarded the surface of the earth as flat and did not take into consideration the spherical shape of the Earth or the curvature of the Earth. We took this into

consideration in our next experiments, using 30 adjustment points distributed proportionately over the test area in carrying out a transformation using a fifth degree polynomial. In this way the distortions deriving from curvature became minimal and completely negligible in mapping.

Eliminating Relief Distortions

But in hilly and mountainous areas we cannot ignore distortions caused by differences in terrain height. Proceeding toward the edge of the picture from the subsatellite point the differences in elevation of the terrain cause point shifts in the picture radiating as a function of distance. A peak at any height above sea level appears in a different place in the picture (if it is not adjusted to the subsatellite perpendicular!) than it would if the peak were at sea level. This shift can be calculated if one knows the planimetric position and height above sea level of the point. For this one needs a digital terrain model which contains, in matrix form on magnetic tape or disk, the altitude above sea level of every single 10 x 10 meter terrain element. From this the computer can calculate and eliminate the distortion of every single pixel.

So, using the procedure compiled by us, one can produce, even for mountainous regions, a multispectral digital cosmic ortho-photo map on a scale of 1:50,000 for both cartographic and resource research purposes.

At present we are trying to use the contour lines of a map to produce a digital terrain model, using them to produce grid points with 10 x 10 meter steps.

In the future we plan to use the stereo pairs of the space photographs themselves, since the information needed to depict relief is contained in the 60 percent overlap; we only need to read it with an appropriate correlation procedure. With this the process would become entirely self-controlled.

We thought through and derived the interdependencies and algorithms of both procedures. We are on the threshold of a solution; preparing the necessary program system is the next task.

We should mention that we have carried out the possible photometric normalization on the three channels of the test area; we have established and tested the stochastic histograms of the picture, the average, frequency, dispersion and covariance and correlation matrixes.

We have determined the function with the aid of which we have been able to achieve in the density values of the pixel field a contrast rendering or contrast intensification which has improved picture quality to a significant degree, making it suitable for 1:50,000 scale mapping.

We have carried out edge accentuation, essence accentuation, density slicing, smoothing, etc. We are about to begin automatic interpretation and classification.

The pictures transferred to magnetic tape are rewritten on film on the Colormation-4500 picture digitizing device. With appropriate magnification we have produced from these films, in black and white and various color versions, as far as we know for the first time in our homeland, a 1:50,000 scale, multispectral, digital cosmo photo map as the basic material for further picture processing.

Conclusions

In our day space photographs have already become suitable to serve as a significant basic material for mapping in the scales from 1:50,000 to 1:1,000,000, aiding resource research, environment research and protection and the solution of the tasks of various branches of the economy, since the resolution of space photographs is being refined virtually day by day.

Using space photographs it seems possible to virtually cover the surface of the Earth with maps and to realize digital picture storage.

It seem useful to begin the development of a space triangulation technology on the basis of space photographs so that precisely determined and harmonized numeric space photo adjustment points will be available in place of cartographic adjustment points, for large areas and with optional density.

Even in the socialist connection, both hardware and software techniques and technology can ensure the possibilities of the digital picture processing necessary for this.

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COMPUTER CONTROLLED SYSTEM AT HUNGARIAN-SOVIET TRANSLOADING STATION

Budapest SZAMITASTECHNIKA in Hungarian Nov 83 p 11

[Article by Peter Braun: "Zahony--The Second Phase"]

[Text] We have turned significant sums to computer technology for a long time. The question sometimes arises: Does it pay off, is it profitable--the investment, the model system, the training?

In our series of articles now beginning we will not be reporting on the creation of developmental systems, that is about the first phase of computer technology. We will describe systems which are working already, where computer technology is not the object of the work but rather a tool for work.

This second phase consists of a system, developed hardware and trained experience.

Many think that the MAV [Hungarian State Railways] is a conservative enterprise reluctant to innovate. The example of the Zahony transloading zone proves the opposite. At a recent conference they described the computer technology solution based on an ESZ 1032 system which has been realized in accordance with the goals set forth.

The Task

The enormous transloading system established at the border loads the contents of wide gauge cars arriving from the Soviet Union into Hungarian or European cars. The contents of shipments going to the Soviet Union must be transloaded in the opposite direction. (See our earlier article, SZAMITASTECHNIKA, April 1980.--The editors.)

Wide gauge trains arrive with cars loaded with various types of goods. In the transloading yards a number of narrow gauge cars are scattered. Lumber and rough piece goods can be transloaded between open cars with a crane; sacked goods (for example, artificial fertilizer) can be transloaded between closed cars with a fork lift; ore and coal can be transloaded by dumping between ore-carrying cars placed one above the other.

One must put together train praks between which the transloading can be done and into which go the goods addressed to the same or nearby places. One must put together trains with domestic or foreign destinations.

To do this one must know what sort of cars are available, what address they are going to, where these cars are, when they will arrive, and when they will leave the area of the transloading station.

The freignt documents, prepared not only for the MAV but also for the customs authorities, must be compiled by mechanical means for the departing trains.

The shipment of goods is not even. Peaks and valleys follow one another by chance for production, weather and commercial reasons. The supply of cars is not even either. Sometimes the empty cars arriving from the interior are not sufficient to receive some type of goods because the type of car need4d is not where it is needed. It is not possible to store the goods, because we are talking about quantitys the storage of which would cause unbearably great expense. The quantity of goods moved each year is about 16 million tons.

The target function for optimization is not constant either. Sometimes one must choose the cheapest solution; at other times speed is the main factor; an unconditional advantage must be given to certain shipment groups.

The Solution

The basis for a solution is precise knowledge of the type and location of the cars. A "car recorder" equipped with a radio set reports the car numbers to the appropriate substation, where this is immediately typed into a VT20. The program running in the VT20 checks the ear numbers (the digits of the car number can be checked in themselves also) and all the data submitted (for example, weight, car type, etc.). This check is a basic part of the system; it immediately corrects errors noted in data received and the radio recorder can go to the next car only if the data are in order. A system which performed this check after the fact would be useless, because the train is leaving.

The data accepted by the VT20 goes onto a 5 M byte disk, and a printing routine running parallel with the data input program prepares the trip documents. From time to time the data stored on disk are sent on to the large central computer. The SZAMALK [Computer Technology Applications Enterprise] prepared a very good monitor for the VT20, handling several programs, and the MAV Computer Technology Plant developed it further.

At the center there are two Polish SEZ 1032 systems with a similar configuration which can be used in the same way; one is in on-line operation and the other serves developmental and error seeking goals and can be connected immediately as a reserve. Each machine has an IDMS data base running on eight 60 M byte disks. The VT20's, emulating IBM 2780 equipment,

are connected to the large computers with TELE-ESZ multiplexers. The data base can be queried with local IBM 3270 compatible Polish terminals. About 50 types of finished tables and a command language to create new tables are available. The car and commodity records of the entire transloading system can be queried from the IDMS data base--with a delay of about 10 minutes--and the appropriate instructions can be issued. The system developed and operated under the leadership of the MAV Computer Technology Plant is working well. As a further development they are working in the direction of complex operational guidance.

The success was not given free of charge. Three years of work by six people were needed to prepare the 3,000 page survey which studied about 300 work sites of the transloading zone. Videoton and the SZAMALK did very great work in addition to the Computer Technology Plant realizing the system. They used very many modules of the IDMS system, making successful use of live data very quickly also.

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